



"Tranquil Bloom" (detail) by Rebecca Hutchinson



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**Design:** Black Moose

**Layout:** Milligram design

### Contact:

Department for Interdisciplinary  
Studies of Culture  
Norwegian University of  
Science and Technology  
7491 NTNU, Trondheim, Norway  
post@nordicsts.org

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# EDITORIAL: AN INTRODUCTION TO CRAFTING SUSTAINABILITY

## *Exploring the Interconnections Between Sustainability and Craft*

By special issue guest editors Roger Andre Søråa & Håkon Fyhn

Sustainability has become a critical issue, calling for new conceptualizations of both problems and solutions. This special issue of the Nordic Journal of Science and Technology Studies explores the concept of "Crafting Sustainability". Sustainability is a hot topic in contemporary scholarly debates, with methodological, theoretical, and conceptual contributions from a wide array of research areas, also from Science and Technology Studies. Craft on the other hand has been less of a focal point, although all humans relate to craft on some level.

The furniture we sit in, the houses we inhabit, the tools we use, hobbies we might have etc. – all have a touch of craft included. As humans, we are craftspeople as well as thinkers; craft is deeply embedded at both societal and personal levels. Understanding how we are impacted by craft can help us explore our own humanity. Maybe something handheld, trustworthy and concrete, as crafted things often are, can help ground us in an era of "fake news", "anthropogenic issues" and "epistemological battles"? Craft, as the process of making provides a connection between people as makers and the things made. Not only pottery and wooden furniture are crafted; truth itself is at some level crafted.

STS has a long tradition of highlighting the craft aspect of phenomena, such as the "doing of science" (Fujimura 1996<sup>[1]</sup>), laboratory studies (Latour 1983<sup>[2]</sup>), and labor study traditions (Sørensen 1998<sup>[3]</sup>). Science and Technology Studies is situated in a unique position for analyzing cross-bred conceptualizations such as the merging of Craft and Sustainability.

We are impacting the world through craft, and in this regard, craft prompts a discussion on sustainability issues. As some of the articles in this issue suggest, craft can be seen as part of a sustainable way forward. But also, the idea that sustainability is likewise a part of craft needs to be taken into consideration. Although this is a Nordic Journal of STS, given this issue's many international case studies we wish to emphasize that sustainability issues are global.

How can we understand craft connected to sustainability? By keeping the focus radically interdisciplinary, we have, in good STS tradition, attempted to open the black boxes of both craft and sustainability.

In June 2017 we initiated and hosted the "Crafting Sustainability Workshop" in the Norwegian city of Trondheim, in order to discuss the connection between craft and sustainability. We invited 17 participants with wide interdisciplinary and international backgrounds. During the workshop it became clear that the connection between craft and sustainability is a very fertile topic. All the articles in this special issue are based on presentations held during this workshop.

At the workshop, we asked the participants to characterise both "Craft" and "Sustainability". This proved to be a task generating a multitude of opinions, but also strong resonance between the diverse views. It was discussed how important the different aspects of time were for different professions, and also how teaching and education practices were vastly different between professions that eventually would collaborate to make the same product, e.g. meet in the building of houses. Craftspeople were emphasized as a rather process-focused profession, rather than designers who were more plan oriented.

Sustainability, it was argued, also had an aspect of time geography that needed to be taken into consideration. Craftspeople are often part of the crafted objects' life journey, and have a large responsibility for the crafted objects' impact on society. It was suggested that attention to embodied practices was a key aspect of co-creating, and that the multitude of stories, practices and experiences would be an interesting strand to explore further.

During the workshop it became clear that despite strong resonance, it was not obvious what we meant while using the two essential terms "craft" and "sustainability". Thus it was suggested that the participants should make a further effort to define or describe what they meant by these terms in their articles. Before we return to these terms, let us briefly introduce the articles in question and the content of this special issue.

The front page of this special issue features an installation called "Tranquil Bloom" made of porcelain paper clay by sculptor and professor Rebecca Hutchinson. For Hutchinson, craft is about the intimacy of connection, and in particular a connection to a place. In an opinion piece at the end of the issue she reflects further on





"Working With Space: An opportunity to be considerate and reflective as a human being". Hutchinson describes how her work has been "shaped by ecosystem observation and researched historical botanical motifs found in historical craft".

The first article in this special issue is called "Crafting sustainability? An explorative study of craft in three countercultures as a learning path for the future". Here Hanna Hofverberg, David O. Kronlid and Leif Östman, ask what 'crafting sustainability' could mean in relation to education for sustainable development (ESD). By identifying purpose, skills and approaches to learning in three countercultures they explore the interrelation of craft and ESD narratives. Further they identify three tensions that needs to be addressed if craft is to be educated as ESD, namely which individuals or collectives, the embodied craft person's relation to the world s/he inhabits and what ecological-social-economic dimensions of sustainable development that are being privileged.

In the second article, Alice Owen explores whether craft enterprises can make a distinctive contribution to sustainable development, using two case studies of small UK-based yarn businesses. Owen especially deals with a social aspect of sustainability, by seeing how the yarn crafters build communities. Owen explores craft as "deploying skilled labour to shape physical materials to create a unique item", and investigates this through micro-enterprises with 3 or fewer employees. She explores this using the theoretical framework of Transition Management, and noting the "Ravelry" social media platform for fibre crafters.

In their article "Refugium WA:

crafting connection through plant-relating arts-science experiences of urban ecology" Tanja Beer and and Cristina Hernandez Santin show how craft and hands-on activities can contribute to enable 'flow' through shared 'vegetal' or plant-based activities in Australia. They describe this through "kokedama" (苔玉 "moss ball"), a plant-binding technique from Japan. They show how kokedama can be seen as a comment on the wider ecological debate. One of the contexts for their research is increased urbanisation, showing how allowing a natural focus enables people to disengage from the negative impacts of that context.

The three last articles all deal with craftspeople and craftsmanship in the building industry. They suggest there is a certain lack of acknowledgment of craftspeople in the building industry today, with design and technology, represented by architects and engineers, appearing to be more in focus. As Mattias Tesfaye (2013<sup>[1]</sup>) notes, there are plenty of well designed buildings being built these days, but fewer are well crafted.

In the fourth article, Kathryn Janda provides a historical study suggesting a decline in status for craftspeople in her article "Crafting sustainability in iconic skyscrapers: a system of building professions in transition?". Here she looks at the media presentations of three

distinct skyscrapers in New York – the Empire State Building, the U.N. Secretariat and One World Trade Center. She examines the division between craftspeople, engineers and architects, and how they are framed in different forms of media relating to the building of these skyscrapers. Being a historical comparative article Janda describes how builders had a larger and more positive role in the local media almost a century ago, whilst modern craftspeople are largely ignored in the stories of how the skyscrapers came to be. Janda argues that greater levels of environmental sustainability can be produced with the integrated involvement of architects, engineers, and builders.

Ruth Woods and Marius Korsnes also point to a lack of attention to craftspeople in the task of reducing energy use and increasing the sustainability of the Norwegian building stock in their article "Between Craft and Regulations: Experiences with the Construction of Two 'Super insulated' Buildings in Norway" (2017<sup>[1]</sup>). They look at how craftspeople involved in the construction of low-carbon and energy efficient houses provide useful knowledge when crafting future sustainable buildings. They investigate this through two pilot projects on sustainable building, a passive house in a small municipality, and a zero emission living lab in a city, seeing how different standards can highlight changing demands on craft in the construction industry. Their article investigates how craftspeople deal with these changes in technical building standards, asking if craftspeople's dedication to their work is impacted upon by changes in practices and if skill can help to bridge the gap.

In the sixth and last research article, "Craftsmanship in the Machine – Sustainability through new roles in the crafts of building at a technologized building site", we (Håkon Fyhn and Roger A. Søråa) look ahead to see what new roles craftspeople might find as building sites become increasingly technologized. We suggest that rather than outsourcing the actual building to the lowest bidder, a better way to go forward is to include craftspeople in the planning process. Through a case study from a high-tech building site, applying Lean Construction and robot-production technology, we also suggest that good craftsmanship might be even more important than before, as great skills are required to handle the technologized production. However, the nature of these skills is transforming from the classical "Workmanship of risk" outlined by David Pye (1968<sup>[1]</sup>). Instead we suggest the term "Craftsmanship of uncertainty" to describe the craftsperson in action at a high tech building site, as the ability to provide certain results in an uncertain situation stands out as essential. The technologized production systems require a level of certainty that calls for such skills. This could also contribute to raising the status for the crafts and of craftspeople at building sites.

What can these articles tell us about sustainability? In her article "Crafting sustainability in iconic skyscrapers..." Janda discusses sustainability in a historical perspective. She notes that the term "sustainable" has been in use for 300 years and has carried three main strands of meaning in this time: (1) capable of being endured; (2) capable of being upheld as true, and (3) capable of being maintained or continued at a certain rate or level. She shows how the third





strand of meaning, dating back to 1924, was not linked to environmental sustainability until the 1970s. As her article follows a historical development that begins prior to the notion of environmental sustainability, she sticks with the the root definition of the term: "capable of being maintained or continued", without connecting it primarily to environmental sustainability. As she points out, such use of the term leads us to the question of what is being sustained by the production of these prestige skyscrapers and by whom?

When talking about sustainability today, it is difficult to avoid the now common definition posed by the Brundtland Commission in the report *Our common future* in 1987<sup>[1]</sup>: "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987<sup>[1]</sup>). Basically this definition can be seen as an elaboration by the historical definition mentioned by Janda: "capable of being maintained or continued". It is further developed into three frames (ibid): Economical, environmental and social sustainability, as the figure below illustrates:



By seeing sustainability in the intersection between these three frames, the articles deal with different conceptualizations of sustainability, and how craftspeople relate to them. In recent contemporary societal debates about sustainability, environmental sustainability has taken much of the spotlight, although traditionally economic sustainability has also been a widely discussed issue. Quite undervalued to the triumvirate is social sustainability, which deals with intra-human societal debates relating to how humans act on and are impacted by sustainability issues. This is something the articles have considered in relation to crafting.

Hofverberg et al. point out that the definition of sustainability may be too wide. They ask, quite in line with Janda's question above, if

it is at all possible to educate for sustainable development, as there so little consensus about what sustainable development means and what it aims for. How can it then guide education? Woods and Korsnes avoid the challenge of the wide definition by using the term sustainability in a more specific way; they limit their definition of sustainability to the building sphere, quoting Berardi (2013:76<sup>[2]</sup>) who suggests that a sustainable building can be defined as "a healthy facility designed and built in a cradle-to-grave resource-efficient manner, using ecological principles, social equity, and life-cycle quality value, and which promotes a sense of sustainable community".

Owen discusses how yarn craft micro-enterprises can contribute to economic sustainability by providing a means for people to enter the economy with flexible work hours. This flexibility to work when and where one wants is important to many practitioners who have other demanding responsibilities in their lives, such as being caregivers, which had caused them to seek out self employment opportunities. She also looks at how these enterprises deal with waste in regards to environmental sustainability, and how social sustainability is crafted at both an individual and a community level. Her analysis suggests that these crafters are simultaneously consumers and producers.

While most articles adhere to the above trinity, we (Fyhn and Søråa) operate with a slightly different model where the economic aspect is replaced with "cultural sustainability". Also this adhere to the root definition: "capable of being maintained or continued", as it has to do with the craft's ability to sustain a knowledge-tradition and practice into the future. But rather than seeing it terms of preservation of culturally valued crafts, we see it in terms of having sustainable communities of practice that brings forward a certain level of skills in building. They do so by changing and adapting these skills to match a transforming reality. In other words, craftspeople are able to make a living from their craft practice in such a way that they ensure future generations will also have the possibility to learn and make a living from high level craftsmanship.

Beer and Santin's article is an interesting exception as it operates with a slightly different angle to sustainability, more akin to the Deep Ecology tradition, quoting du Plessis and Brandon (2015:56<sup>[3]</sup>) they write that: "Sustainability is based on a value system which holds that both people and nature should be treated with respect and in a spirit of fellowship and mutuality, and actions should focus not only on the wellbeing of humans, but on the wellbeing of the entire social-ecological system. This means that humans have a duty of care that requires them to support the wellbeing and evolution of the social-ecological systems of which they are part, and take responsibility for the consequences of their actions."

We further encouraged the authors to reflect on the word Craft in their articles. Fyhn and Søråa's article approaches craft in terms of David Pye's (1968<sup>[4]</sup>) distinction between workmanship of risk and workmanship of certainty: while the former points to free handed



forming, the latter points to forming guided by a machine; the former tends to be associated with craftsmanship, the latter with machine operation. At the technologized building site Fyhn and Søråa suggest the term “craftsmanship of uncertainty” to grasp the new roles for the crafts of building in securing certain results in a situation characterised by uncertainty.

Woods and Korsnes also discuss craft in the context of building, and they refer to Sennet’s (2008<sup>[1]</sup>) more ethical definition of craft, focusing on attitude towards the work; craftspeople are “dedicated to good work for its own sake”. This represents the special human condition of being engaged and take pride in their work. Woods and Korsnes find that this work ethic is present within the construction industry of their case studies.

Rather than approaching craft by describing particular and typical skills, Janda in her article approaches builders as a profession in relation to other professions, such as engineers and architects. Drawing from Andrew Abbott’s (1988<sup>[2]</sup>) “system of professions”, she is able to show different nuances in the approach to craft, focusing on the mutual interdependence between the professions, at the same time as the status relations between them fluctuates. Her article concludes by arguing that greater coordination between designers and doers in the construction industry, of the kind exhibited in the early days of skyscrapers, would enable the social production of sustainable buildings. For this to happen, however, society would need to place a higher value on tangible outcomes in the built environment.

In her article, Beer uses Sarah Kettley’s (2016<sup>[3]</sup>) contemporary understanding of craft, focusing on the collaborative creativity and potentiality. Her focus is on the collective experiences of craft and sees it in a global context, using plant-crafting from Japan at craft-installations in Australia adhering to the Japanese concept of “wabi -sabi” (roughly translated as seeing the imperfection in created things). Although the crafts of building seek perfection, by putting forth imperfection as an ideal, they suggest that craft can become a way to bring people together through communal imperfection. Here they open a topic that seems to be essential regarding craft: showing how it fosters community through collective making. Whether it is the collective experience of making kokedamas, or the community of practice at the building site, making together fosters and requires community.

Community is also essential in Owen’s article, even if the micro enterprises are distributed and many work alone with their yarn, the development of this crafting as enterprise is a communal effort that both depends on and builds community. Owen emphasizes how craft activities range from the hobby level to the professional level. More specifically she defines craft to mean “deploying skilled labour to shape physical materials creating a unique item.” She explores how innovation and problem solving are keys to craft as a creative application of skills. The desired outcome of the crafting process is by Owen seen as technical, due to the manipulation of materials in order to achieve the intended outcome of the crafted object.

Rather than focusing on manipulation of objects, Hofverberg et al. focus on the hands working with materials in their definition of craft. Quoting Adamson (2007:3<sup>[4]</sup>) they address craft as “making something well through hand skill”. To this definition, Hofverberg et al. add that the human-material interrelations are an essential aspect of learning craft, connecting to Ingold’s (2013:31, 69-70<sup>[5]</sup>) concept of “making as correspondence”. Thus they define craft as “skilled hands making products (together) with materials.” With this definition they are able to explore a craft pedagogy that is needed when craft is educated as a learning path for the future.

Hofverberg et al. point out that crafted things are often associated with something genuine. Thus, one might wonder why it is associated as something genuine? Is it because it produces one of a kind things? Maybe the beautiful imperfection described as wabi-sabi plays a role in this? Or is it because there is a relationship of genuine engagement, as mentioned by Woods and Korsnes, between the craft person and the crafted thing? Or is the crafted thing genuine because it is handmade, thus providing a unique and one-of-a-kind connection through the unique making process between the crafts person and the thing? This definition also provides a comment to the topic of Fyhn and Søråa’s article on technologization: it is not meaningful to say that a machine takes pride in its work, which can lead to new questions to what this implies in respect to automation.

Can the focus on connection between people and things also teach us something about sustainability? A crafting sustainability approach focuses on the connection between people, their practices and materialities; these are intertwined and form each other in co-production. Maybe emphasizing such connection in craft can help us point to more sustainable ways forward? “Moving forward by looking back” is a phrase that was mentioned at the initial workshop. Maybe looking backwards towards our crafting connection to the world can be a way to connect for a sustainable way to move forward? The context that the special issue grew from, the Crafting Sustainability workshop, has served as a grounding for this work.

We are proud to finally present this special issue on Crafting Sustainability. It deals with a wide variety of crafting, from craftspeople building gargantuan skyscrapers (Janda) to hypermodern passive houses (Fyhn & Søråa; Woods & Korsnes), to educational craft practices such as Educational Sløyd (Hofverberg et al.) and micro-enterprises (Owen), and also art installations probing questions of what crafting can mean (Hutchinson; Beer & Santin).

The special issue seeks to explore what craft is, what sustainability is, and how these two concepts can be understood together in the term “Crafting Sustainability”. We hope the readers will gain insight and ideas from a topology that is quite different in an STS setting. We thank the editorial board of NJSTS for the opportunity to guest edit this special issue, and warmly recommend it for other emerging research fields and networks in the making. We wish you, the reader, a pleasant reading experience as you delve into the world of Crafting Sustainability.



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# CRAFTING SUSTAINABILITY?

## *An Explorative Study of Craft in Three Countercultures as a Learning Path for the Future*

by Hanna Hofverberg, David O. Kronlid & Leif Östman

*This article explores and seeks to identify what 'crafting sustainability' could mean in relation to education for sustainable development (ESD). Certain ESD craft pedagogies are explored in three countercultures (from 1900, 1968 and 2017). The empirical data consists of literature from or about these three countercultures. A broad notion of sustainability and the educational philosophies of perennialism, essentialism, progressivism and reconstructivism are used as theoretical frameworks. The findings show the countercultures' educative craft purposes, craft skills and approaches to learning craft and the possible implications for ESD. In particular, three tensions concerning the implications of an ESD craft pedagogy are discussed.*

**Keywords:** *craft, sustainability, education for sustainable development, pedagogy, countercultures*

**Authors:**  
**Hanna Hofverberg**  
*Doctoral student*  
Dept. of Education, Box 2136, SE-750 02, Uppsala, SWEDEN  
**David O. Kronlid**  
*Associated Professor*  
Dept. of Education, Box 2136, SE-750 02, Uppsala, SWEDEN  
**Leif Östman**  
*Professor*  
Dept. of Education, Box 2136, SE-750 02, Uppsala, SWEDEN

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## Introduction

This article connects craft with education for sustainable development (ESD). One of the interests emerging out of the current craft movement (Cummins, 2010<sup>[1]</sup>, Jacob, 2013<sup>[2]</sup>, Luckman, 2015<sup>[3]</sup>) is that craft and craft knowledge are promoted as contributing to environmental and sustainability issues and that learning craft therefore contributes to a sustainable future. Even though many people connect craft ideas and the numerous experiences that crafting associates with a sustainable future, few seem to problematize how such pedagogy is being made in relation to environmental and sustainability issues. For example, whom and what does it concern, what crafting skills are needed and what sustainability claims are being made? These are all relevant questions to ask if one is to teach craft as ESD.

The concept of sustainable development was introduced by the UN General Assembly as a way of engaging environmental and development policy to vision a sustainable future that meets the needs of the present generation without compromising those of future generations (WCED, 1988<sup>[4]</sup>). Accordingly, sustainable development is defined as a social process in which ecological, social and economic processes are treated and analyzed as three interdependent yet mutually reinforcing dimensions of development (WCED, 1988<sup>[4]</sup>; SOU, 2004<sup>[5]</sup>). Moreover, education is often put forward as a pathway to sustainable development. Indeed, quality education is integrated to all goals and specifically to number four in the United Nations 17 sustainable development goals in Agenda 2030 (UNESCO, 2015<sup>[6]</sup>). Acknowledgement of the importance of access to education is paired with an increasing interest in the acceleration of quality education at all levels and areas of education (ibid.). However, Jickling (1992<sup>[7]</sup>) argues that in an education context it is impossible to educate for sustainable development, because there is no consensus about what sustainable development means or what it is aiming for. Similarly, Scott and Gough (2003:2<sup>[8]</sup>) argue that the discourse of sustainable development does not present a straightforward answer or solution to global challenges. Rather, it introduces the different definitions of sustainable development that have emerged in different practices, both in relation to the main purposes of these practices and how the practice understands the environment, our place in it and the

consequences of our actions. As a response to this, scholars are now suggesting that ESD research emerges in the nexus of questions about subject matter on environmental and sustainability issues (such as norms and values, people-society-environment relationships, knowledge, local and global orientations etc.) and educational aspects (critical thinking, democracy, learner agency, participations taking action on environmental and sustainability issues etc.) (Stevenson, Brody, Dillon and Wals 2013:2<sup>[9]</sup>, Van Poeck and Lysgaard, 2016:308<sup>[10]</sup>). Hence, in order to understand "crafting sustainability" we need to explore what are privileged as important in a practice' sustainability narratives and how such pedagogy is being made.

The aim of this article is to identify 'crafting sustainability' in relation to ESD. In other words, we are interested in identifying different sustainability narratives in relation to craft and analyze its pedagogy. Craft has a long history of being highlighted as an important pathway to more sustainable future. Hence, we have analyzed three waves of international interests in craft (Luckman, 2015<sup>[11]</sup>) in which craft is claimed to contribute positively to societal change. By examining how purposes, desired skills and approaches to learning craft emerge in these waves, or countercultures, we suggest certain ESD craft pedagogies. It is important to point out that we are not examining whether or not the countercultures are sustainable, nor do we intend to create new knowledge on the craft-traditions themselves. Rather, the study should be regarded a starting point for exploring the creative contribution that craft activities can make to the development of ESD practice. Accordingly, the study should speak to educational researchers and practitioners engaged in the long tradition of informal, non-formal and formal craft education in the Nordic countries and beyond.

The article's first section provides a background of craft and craft education. The second section presents the theoretical framework of sustainability and educational philosophies, the methodology and empirical data. The third section presents the findings: a text presentation followed by a summary. In the article's final section, the findings are discussed with the philosophical typology and the implications for ESD.

## Background: craft and craft education

Craft is often associated with something that is genuine and hand-made. According to Frayling (2011:9<sup>[12]</sup>), this is manifested when major manufacturers promote their wares using craft language, such as "handmade", "hand-finished", "made by our craftsmen", often in combination with 'organic', a word that is repeatedly associated with craft. But what does it mean more specifically? Adamson (2013<sup>[13]</sup>) argues that if we want to understand how craft operates around us, we need to understand the ways in which crafting is influenced by how time, the notion of skills and symbolism emerge in crafting action (231<sup>[14]</sup>). Further, according to Adamson (2007:3<sup>[15]</sup>), craft can refer to a category, an object, or an idea. It can also refer

to a process. He defines craft as "making something well through hand skill" (2013: xxiv<sup>[16]</sup>). We concur with Adamson's definition, but would like to add human-material interrelations as an important aspect of the meaning of craft, in what Ingold (2013:31, 69-70<sup>[17]</sup>) defines as "making as correspondence". Hence, in this article we define craft as *skilled hands making products (together) with materials*.

One way of framing craft practices is to identify them as formal, non-formal and informal education. As formal education, learning crafting corresponds "to a systematic, organized education model, structured and administered according to a given set of laws and



norms, presenting a rather rigid curriculum as regards objectives, content and methodology" (Zaki 1988:1<sup>[9]</sup>). As non-formal education, craft also exists in educational practices that Zaki (1988:2<sup>[9]</sup>) characterizes as having "flexible curricula and methodology", that is "capable of adapting to the needs and interests of students" and "is contingent upon the student's work pace" (ibid.). Finally, as informal education, crafting exists in practices that do not "correspond

to an organized and systematic view of education" (6). As such, it does "not necessarily include the objectives and subjects usually encompassed by the traditional curricula" (ibid.). Accordingly, even if a craft practice does not have a formal curriculum, it can operate as an educative practice. How we address this aspect of crafting is further developed in the description of the theoretical framework and methodology.

## A theoretical framework

### A broad notion of sustainability

First, we deliberately adopt a broad definition of sustainable development as a multileveled process in which social, ecological and economic processes function together to maintain a resilient socio-ecological system. Such a broad definition works to our advantage, in that it allows us to analyze how "sustainable development" or "sustainability" emerges in the studied crafting practices. In other words, we examine the educative purpose of craft in order to be able to say something substantial about the different countercultures' visions of a more sustainable future. Overall, the fact that the result of the study portrays the different craft practices as countercultures is of relevance for their sustainability narratives. Indeed, it is likely that the practice of countering something (often what is perceived as a hegemonic situation of relevance for the practice in question) is part of the privileging of the content of the said practices. Consequently, it is to be expected that the different notions of sustainability that emerge in the countercultures of craft presented in this article are related to their countering qualities. However, this study does not aim to explain why particular notions of sustainability emerge. Rather, the aim is to explore which notions of sustainability emerge and relate them to fundamental educative purposes. The question of why notions of sustainability emerge is important, but is far too wide a topic for this particular study. A broad analytical definition of sustainable development is helpful because it allows the concept to be applied to the material that was published before sustainable development became a popular area of research and policy. As we are looking for emergent notions of sustainability, qualities can be identified as what we currently refer to as sustainability narratives, regardless of whether they were or are "told" and were or are not codified in sustainability terms.

Second, one of the perhaps most significant questions about any practice involving learning and/or education is: What is its purpose? This could have negative connotations, as in 'what is the point of learning how to craft?' However, questioning the purpose of a practice is an effective way of identifying its learning content. Accordingly, drawing on a typology of educational philosophy, we are interested in which, if any, learning claims are embedded in the craft counterculture movement. Hence, in relation to the question of how crafting relates to a foreseeable sustainable future, educational philosophy is used as a theoretical framework in order to highlight the purposes, views of knowledge and approaches to learning that are adopted in the various strands of craft and crafting.

### A philosophical typology

In our exploration of the emerging educative value of craft counterculture movements we use an educational philosophy typology (see Brameld, 1950<sup>[9]</sup>). This is because these philosophies represent "different ways of evaluating the content and procedures of educative practices in relation to its *specific purpose* and *[its] societal role*" (Öhman 2006:28<sup>[9]</sup>. Our translation and italics). The educational philosophy typology of four approaches, namely:

A *perennialist* approach to education is often based on the idea that a certain kind of basic knowledge (and values) is vital. Accordingly, education should focus on knowledge and skills that enforce and guide discipline, control and order to legitimize current social hierarchies, e.g. patriarchy. Moreover, collective societal goals are downplayed when the education focuses on each individual citizen's spiritual growth (Gustavsson 2002:87-88<sup>[9]</sup>). Accordingly, perennialism acknowledges learning as an individual endeavour, even though the individual does not take an active part in the learning process, but is simply the recipient of knowledge and skills.

A second approach to education, *essentialism*, emphasizes that scientifically grounded knowledge and skills should be transferred from the teacher/expert to all students, regardless of class and experience, and be operationalized to create a functional society by means of clear objectives, facts and technology. The main purpose is to enlighten students through scientifically verified knowledge about the world. Thus, skills such as ranking and categorization are important in that they lead to a separation of the educational content into specific subjects. Here there is an emerging split between theory and practice, in that the operationalisation of facts into socially useful functions becomes a priority (Gustavsson 2002:88-90<sup>[9]</sup>, Englund, 1997:133<sup>[9]</sup>).

This celebration of utility-oriented and expert-led education is questioned by *progressivism*, according to which the purpose of education is to function as a potentially strong social transformative force by facilitating the learning of deliberative practices and action. The strong demarcation between school (theory) and everyday life (practice) that essentialism implies is blurred as learners' experiences are considered vital for efficient and relevant learning. Thus, "learning by doing" becomes important, in the sense that progressivism highlights how education can enable learners to identify, differentiate and deal with social challenges





collaboratively in order to sustain democracy and increasingly celebrate deliberative organizations and institutions (Gustavsson 2002:90-93<sup>[1]</sup>).

The institutional and organizational inertia from which progressivism sometimes suffers creates *reconstructionist* responses, according to which the purpose of education is to continuously remodel society, its politics, ideologies and values. This transformative and reformative approach to education suggests that social norms, institutions and ways of dealing with and assessing scientific facts are best approached as social constructs. In addition, education is seen to be played out on a conceptual continuum of consensus and controversy. Interestingly, socio-materiality becomes a topic of concern for reconstructionism. Matter is no longer considered as the static backdrop of human, i.e. political action, but is instead problematized as communicative and intermeshed with the social. Hence, socio-materiality both enables and inhibits learning and educational objectives, in that it contributes to the sedimentation of certain educational content and social structures (93-96<sup>[1]</sup>).

## Analytical procedure and method

As in all analyses, our methodology is guided by the purpose of the study (Säfström & Östman, 1999<sup>[2]</sup>), which in this case is to identify 'crafting sustainability' in relation to ESD in different craft traditions. To fulfil this purpose, the study is guided by the four research questions introduced above and which correspond to the following three steps: selection of study material, analysis and critical discussion of the implications for ESD.

### Step one: Selection criteria and material

The first step of the study was to select the study material according to three selection criteria: (a) that the craft tradition is relevant in relation to our stipulated broad notion of sustainability (see above), (b) that the craft tradition deals with formal, non-formal or informal educational activities, which refers to how the activities are potentially (perennialist, essentialist, progressivist and/or reconstructionist) educative and result in the learning of new facts, skills and values in relation to issues of sustainability and (c) that the selection of material maximizes a variation in views of how craft is related to sustainability. The maximum variation criterion (including using gender variation, i.e. stories about craft and sustainability from both "female" and "male" participants) meant exploring material beyond and within the Nordic context<sup>1</sup>. Maximizing variety is important from a discourse-analytical perspective, because by contrasting Nordic craft practices from the perspectives of craft movements emerging in other regions, the similarities and differences between Nordic craft values, norms etc. and those of "outsiders" become visible and possible to explore (Eagleton,

We have used these four different approaches to education to elicit a number of research questions that will help us identify the relationship between education, craft and sustainable development.

- 1) What is the educative purpose of craft?
- 2) Which craft skills are valued to achieve the purpose?
- 3) Which approaches to learning emerges in the practice of craft?
- 4) What are the implications of "crafting sustainability" for ESD?

Identifying the main purpose of craft as it emerges in the different practices is vital in order to understand how craft portrays itself as a practice concerned with a sustainable future (Q1). In this, it also is important to identify the kind of skills that are regarded as important to achieve the purpose (Q2). Finally, the approaches to learning are identified, i.e. how a subject is taught and learnt, by whom and how the teaching and learning is made visible in practice (Q3). Consequently, answering Q1-3 will help us to understand the meaning of "crafting sustainability" and to discuss its implications for ESD (Q4).

1989<sup>[2]</sup>). Importantly, the variety should not be too "different", because that would diminish the relevance of the results for enabling a critical-creative discussion about craft, education and sustainability in the Nordic context. Thus, the ambition with this article is that the results of the study, which both mirror and differentiate between Nordic and other craft traditions, will facilitate critical-creative discussions.

Although there is an extensive body of relevant literature, there is a limit of the amount of literature that can be covered in one article. This means that the study should be perceived as a starting point for exploring the creative contribution that craft activities can make to the development of ESD<sup>2</sup>. Moreover, the craft traditions that are focused on in the analyses are both different from and similar to the Nordic craft traditions. An example of the latter is how the first wave (described by Otto Salomons and Uno Cygnaeus) highlights ideas of craft education, how the second wave and the "gröna vågen" (green wave) in Sweden and Norway during the 1970s share similar ideas and how the third wave's practices has Nordic similarities. For example, Arnqvist (2014<sup>[3]</sup>) identifies craftivists as "guerilla slöjd" drawing in Nordic examples. Also, in the woodworker tradition, "spoonfests" (spoon carvers meeting at Sätergläntan in Sweden) and "makerspace" (meeting in different places in the Nordic countries) are also common in the Nordic countries today.

By utilizing the three selection criteria, we have explored British, North American and to some extent Swedish craft traditions and

<sup>1</sup> This could also embrace race and class, or take an intersectional approach. We are aware that this would increase the value of this selection criterion, although due to limited space and the relevance of gender in the history of craft, we have chosen not to examine race and class, or take an intersectional approach.

<sup>2</sup> Thus, our ambition with the study is not to give a full historical description of a particular movement, the texts, the author's intentions, or what the texts might have meant to the reader at the time in which they were written.



used time to both indicate internal variation (Cummins, 2010<sup>[1]</sup>, Jacob, 2013<sup>[2]</sup>, Luckman 2015<sup>[3]</sup>) and to point to three specific countercultures, or waves of international interest in craft: 1900, 1968 and 2017.

The first wave reflects the arts and crafts movement at the turn of the nineteenth-twentieth centuries. This movement started in England around 1900 and spread throughout Europe, America and Japan. Here, literature describing John Ruskin's and William Morris' ideas about craft is studied using texts by Adamson (2013<sup>[4]</sup>) Frayling (2011<sup>[5]</sup>), Jackson Lears (1981<sup>[6]</sup>), Morris (1968/2010<sup>[7]</sup>) and Sennett (2008<sup>[8]</sup>). The narrative that is drawn from this literature is mainly about craftsmen. In accordance with the criterion gender variety, we also present findings from the Swedish home crafting movement (hemslöjdsrörelsen) emerging in Sweden at the time. Here, we focus on general ideas about craft using the works of Danielson (1991<sup>[9]</sup>), Isacson (1999<sup>[10]</sup>), Lundahl (1999<sup>[11]</sup>) and Waldén (1999<sup>[12]</sup>).

The second wave, which coincides with the heady countercultural hippie days of the 1960s and 1970s, was the result of a Euro-American social movement that produced a variety of political ideas and actions embracing inclusive, non-profit and non-violent activism (Lewenhaupt, 2002:135<sup>[13]</sup>). Two groups can be identified in this movement. The first is sometimes referred to as 'hippies' (from the words hip and happy). As there are no clear pioneering figures, we draw on Lennerht (2000<sup>[14]</sup>), Lewenhaupt (2002<sup>[15]</sup>), Eldvik (2010<sup>[16]</sup>) and Morozov (2014<sup>[17]</sup>) to present the general craft ideas of the period. The second group is headed by Steven Brand, who created the "Whole Earth Catalogue". Here, important literature for the analysis is that of Kirk (2007<sup>[18]</sup>) and Morozov (2014<sup>[19]</sup>).

Finally, we have dated the third wave to 2017, because it reflects the current movement. Here, material from three groups are studied: the woodworker tradition (Schwartz 2011<sup>[20]</sup> and Sellers 2015<sup>[21]</sup>), the "craftivist" movement (craft + activism) (Greer 2008<sup>[22]</sup> and Levine and Heimerl 2008) and the "makers" movement (Hatch 2013<sup>[23]</sup> and Anderson 2012<sup>[24]</sup>).

Altogether, all the material (both first and second-hand) are central authoritative sources (Esaïasson, Gilljam, Oscarsson and Wängnerud, 2007:291<sup>[25]</sup>). Where central authoritative sources (i.e. in the hippie tradition) are lacking we have been obliged to use other sources, such as craft and fashion literature.

## Educative purposes in the first wave: 1900

### Arts and crafts movement

John Ruskin and William Morris, pioneering figures in the arts and crafts movement, claimed that true craftsmanship had disappeared and been lost to machines (Jackson Lears, 1981:62, 83<sup>[26]</sup>).

### Step 2: Analysis

The second step of the study was to analyze the selected material following research questions 1–3 (see above). First, the material was coded in relation to the question of the educative purpose of craft. As a result of this coding, we were able to discern the differences between the different craft countercultures described above as a synthesised answer to the question of the educative purpose. As mentioned above, a purpose-oriented analysis emphasizes the content of the practice, which is highlighted in terms of its concrete aims. This means that any part of the studied material that explicitly expressed an intention of an activity, a desirable outcome, or a recommendation was coded in terms of its purpose, goals and aims and was analyzed further. The results of this analysis are presented in the findings section, together with a text for each movement.

Secondly, the analysis focused on identifying and classifying the kinds of skills and approaches to learning that could be deduced from the already analyzed purposive activities. Accordingly, the coded data was used as a starting point for the analyses, because the purpose of an activity is often described in concrete terms, such as how to acquire certain skills, become more socially responsible, or develop the self. The deduction was informed and complemented by a second coding using sensitizing concepts describing the kind of content and outcome that was talked about, i.e. skills. Regarding the analysis of different approaches to learning, particular attention was paid to identifying participants the different practices involved: learners/students, teachers/educators/facilitators and material. The difference between the approaches to learning crafting are largely defined by who or how these categories are populated and how the interaction between the participants can be characterized. The results of the analysis are presented in the findings section in terms of four identified skills - where all the movements are presented together, and two approaches to learning. The results from questions 1 - 3 are summarized in a table (figure 1).

### Step 3: Implications for ESD craft pedagogy

The third step of the study involved discussing the implications of the results for ESD (question 4). These are presented in the discussion section, below. This involved relating the results of the study according to the philosophical typology (questions 1-3). Here, each craft practice analyzed was related to the philosophical typology and, for the sake of clarity, presented as an image (Figure 2). To further emphasize the implications for ESD, three ESD tensions were discussed.

They argued that crafts people should return to working with their hands, as this gave them joy. Ruskin argued that "medieval cathedral builders (unlike modern factory hands) remained satisfied with their material lot because they found joy in their

<sup>3</sup> Thus, our ambition with the study is not to give a full historical description of a particular movement, the texts, the author's intentions, or what the texts might have meant to the reader at the time in which they were written.



labour" (ibid.). Ruskin's anti-machine stance can also be noted in his argumentation about how good craftsmanship is learned:

You can teach a man to draw a straight line; to strike a curved line, and to carve it...with admirable speed and precision; and you will find his work perfect of its kind: but if you ask him to think about any of this forms, to consider if he cannot find any better in his own head, he stops; his execution becomes hesitating; he thinks, and ten to one he thinks wrong; ten to one he makes a mistake in the first touch he gives to his work as a thinking being. But you have made a man of him for all that, he was only a machine before, an animated tool. (Ruskin quoted in Sennett, 2008:133<sup>[4]</sup>)

For Ruskin, it was important for the craftsman to keep control of the entire crafting process, which meant having the right skills and the right knowledge about the process as a whole (Sennett, 2008:113<sup>[4]</sup>). He thus favoured small products, such as woodworked ornaments, which he regarded as beautiful examples from skilful hands. In addition, Ruskin argued that craftsmanship meant being willing to do something well for its own sake, even when faced with difficulties (114<sup>[4]</sup>). Another educative purpose of craft is the making of beautiful items (ibid.). According to Adamson (2010:146<sup>[5]</sup>), creating useful and beautiful items is also noticeable in one of Morris' favourite proclamations: "have nothing in your houses that you do not know how to use or believe to be beautiful".

## Educative purposes in the second wave: 1968

### Hippies

Luckman (2015<sup>[6]</sup>) acknowledges that the second (hippie) wave of international interest in craft occurred in the 1960s and 1970s. Hippies embraced craft for its political and back-to-the-earth qualities (Wagner, 2009<sup>[7]</sup>). Back to nature was a slogan that inspired young women and men to start crafting. A strong tendency to knit and crochet garments and household items like blanket and lamps emerged (Lehnert, 2000:72<sup>[8]</sup>), strengthening the main purpose of craft as political, in the sense that its project to "go back to nature" and become self-sufficient was defined in contrast to mainstream politics. However, as Wagner (2009:2<sup>[7]</sup>) points out, for the most part, its participants tossed quality aside and instead maintained that anyone could learn to craft.

Here, the main educative purposes are: (a) political in its aim to "go back to nature" and (b) to become self-sufficient.

### "Whole Earth Catalogue"

In this period, another counterculture movement emerged that also celebrated simplicity, back-to-the-land sloganeering and especially the endorsement of savvy consumerism as a form of

To summarize, the educative purposes of craft are: (a) to give the craftsman joy, (b) to have the expertise and skills to control the entire crafting process, (c) to be willing to do something well for its own sake and (d) to make the crafted item beautiful.

### The Swedish home craft movement

Another movement that emerged around 1900 in Sweden was the Swedish home craft movement<sup>4</sup>. Danielson (1991<sup>[9]</sup>) argues that the purpose of craft in the Swedish home craft movement was for craftswomen to make functional, durable and neat products<sup>5</sup>. Another purpose of craft was to make beautiful products (Waldén 1999:77<sup>[10]</sup>; cf. Ågren 1999:52<sup>[11]</sup>). According to Waldén, beauty was accomplished through heritage and tradition. For example, old folk patterns, such as old lace patterns, are beautiful, whereas the new crocheting patterns found in contemporary journals are not (ibid.).

What was considered beautiful was also a reaction to industrial mass production (Danielson, 1991:202<sup>[9]</sup>). The 'modern' product was repeatedly compared with traditional, individual and necessary home products (Waldén, 1999:77<sup>[10]</sup>). Finally, the movement gave rise to the purpose of craft as educating Swedish women in good taste and good behaviour (Lundahl, 1999:211<sup>[12]</sup>).

In this movement, the educative purposes of craft are: (a) to make products that are functional, durable and neat, (b) to make beautiful products and (c) to educate Swedish women in good taste and behaviour.

political activism (Morozov 2014<sup>[13]</sup>). Stewart Brand, one of the prime movers, argued "the consumer has more power for good or ill than the voter" (2). In 1968, Brand published the first issue of the "Whole Earth Catalogue", which states:

We are the gods and might as well get good at it. So far, remotely done power and glory – as via government, big business, formal education, church – has succeeded to the point where gross obscure actual gains. In response to this dilemma and to these gains a realm of intimate, personal power is developing – power of the individual to conduct his own education, find his own inspiration, shape his own environment, and share his adventure with whoever is interested. Tools that aid this process are sought and promoted by the Whole Earth Catalog. (Brand quoted in Kirk, 2007:1<sup>[14]</sup>)

Accordingly, the idea with the catalogue was to provide readers with tools that "generate a holistic, expansive guide to modern life that defied reductive categorization and promised all readers a return to personal, individual agency and autonomy" (Kirk, 2007:2<sup>[14]</sup>). In other words, with the aid of these tools a person could make or craft anything he or she wanted to. Brand wanted to create a

4 In Swedish this is called "hemslöjdsrörelsen".

5 In Swedish, "ändamålsenligheten, varaktigheten och prydligheten".





service that would blend liberal social values and technological enthusiasm with the emerging ecological worldview that he as a biology student encountered at Stanford University (ibid). Here, the pur-pose of craft is to become self-sufficient, but instead of doing it together with others, like the hippies, to do it on a more personal and individual basis. Brand's interest was to combine

technology with an ecological worldview, the goal being to provide every individual with a personal computer.

Here, the educative purposes are: (a) political in order to become self-sufficient and (b) through craft to combine technology with an ecological worldview.

## Educative purposes in the third wave: here dated at 2017

Luckman (2015<sup>[6]</sup>) defines the present-day attentiveness to craft as the third wave of international interest (cf. Cummins, 2010<sup>[7]</sup>, Jacob, 2013<sup>[8]</sup>). Anderson (2012:13<sup>[9]</sup>) states that the movement is characterized by making (product or process) that is shared online: "Individual makers, globally connected, become a movement". As the movement is not easily portrayed as one unit, we present three groups, all of which share their crafting and making (product or process) on the internet.

### Woodworkers

Woodworkers Paul Sellers and Chris Schwartz have many followers on their blogs and YouTube channels and reach out to thousands of people every week. Sellers describes his mission as follows:

What we teach today is working to re-establish methods that have real value for the wellbeing of woodworkers and wood-working as a whole. I may not like the computer too much or the internet for that matter, but reaching hundreds of thousands of people every week worldwide means I have peace about the future of woodworking now that it no longer relies on adverts, magazines and machine manufacturers steering the future but an ever-increasing body of woodworkers who care about skilled work in real woodworking. (Sellers, 2015<sup>[10]</sup>)

In this quotation, Sellers points to several woodworking purposes, such as re-establishing methods with real value for well-being, knowing woodworking as a whole and caring about skilled work in real woodworking.

Schwartz (2011:10<sup>[11]</sup>), also a woodworker, argues that woodworking is a political act. Accordingly, "[w]oodworking might seem a traditional, old-time skill, it is quite radical in this consumerist age where buying stuff is good and not buying stuff is considered fringe behaviour". Schwartz continues by pointing to the craftsman's expertise: "the mere act of owning real tools and having the power to use them is a radical and rare idea that can help change the world around" (11). Both Sellers and Schwartz mainly teach people how to make furniture and useful woodworking items.

Here, the educative purposes are: (a) to re-establish woodworking methods, (b) to know woodworking as a whole, (c) to create well-being and (d) to become political by knowing how to woodwork.

### "Makers"

This group consists of what the participants themselves call 'makers'. They argue that they "do what they love", which is to invent things. Anderson (2012:11<sup>[12]</sup>) argues that:

Making is fundamental to what it means to be human. We must make, create and express ourselves to feel whole. There is something unique about making physical things. Things we make are like little pieces of us and seem to embody portions of our soul.

One of the purposes of this maker-practice is to invent new things. Another purpose is that invention, i.e. the making, creates a feeling of wholeness. Hatch (2013:2<sup>[13]</sup>) exemplifies what makers need to do in the *Makers' Manifesto*. He suggests that makers should *make, share, give, learn, tool up, be playful, participate, support others and change*. At the end, Hatch concludes by saying that "since making is fundamental to what it means to be human, you will become a more complete version of you as you make" (ibid.). Drawing on the manifesto, being playful, sharing your knowledge with others and strengthening identity help makers to be self-fulfilled. Due to the cultural norm of sharing designs and collaborating with others in online communities, the practitioners use open file standards that allow anyone "to send their designs to commercial manufacturing services to be produced in any number, just as easily as they can fabricate them on their desktop" (Anderson, 2012:21<sup>[14]</sup>). The products that are made can be anything that uses technology in combination with analogue making, such as 3D printers or soldering iron.

For makers, the educative purposes are to: (a) do what you love, (b) invent new things, (c) be creative, (d) share and support others and (e) become a more complete version of yourself as you make.

### "Craftivism"

It is argued that the last group, "craftivism" (craft + activism), is a marriage between historical technique, punk culture and DIY (Do It Yourself) ethos and is influenced by traditional handicrafts, modern aesthetics, politics, feminism and art (Levine & Heimerl, 2008<sup>[15]</sup>). Greer (2008<sup>[16]</sup>) argues that craftivism is a reclamation of the hand-made, which according to Greer proves that these craft skills are valuable, worthwhile and something to be proud of. The purpose of craft is not just to create for its or your own sake. Instead, Greer



argues, using your crafting skills and creativity enables you to take part in your community as a responsible member:

One of the benefits of social engagement is that you knock people out of their routine and make them notice things they would normally overlook. You got them to stop and say, "I've never seen that before", instead of looking down to their feet as they normally do. When you see a light pole with a knitted band of bright colours around it, you notice the pole itself instead of letting it blend into the background ... By making our surroundings a little more beautiful, we claim responsibility for our environment. (63<sup>[9]</sup>)

## Craft skills

As they have emerged in the first step of the analysis, the different purposes of craft can also be discussed in terms of which craft skills are acquired. Here, skill is defined in accordance with Ingold's (2000:316<sup>[9]</sup>) understanding of skill as a form of knowledge and form of practice. In the purpose-based analysis, we have identified four different skills that we found in the empirical data: (a) functional skill, (b) aesthetic skill, (c) spiritual skill and (d) etiquette skill. These different types of skill are described below.

### Functional skill

Functional skill can be identified in all three waves. In the arts and craft movement and in the woodworker tradition it means learning how to master the various crafting techniques in order to control the entire crafting process. In the Swedish home and craft movement, functional skill leans more towards utility, i.e. mastering techniques in order to make functional and durable products for the household. A third aspect of functional skill arises during "the Whole Earth Catalogue" movement. Here functionality is blended with skill about how to be creative and innovative in order use the tools in an entrepreneurial way.

In crafting, functional skill can also be understood as knowing the handicraft in order to transform society, as it is exemplified during the present craftivism movement as a political practice. A final aspect of functional skill entails embodied knowledge and material awareness in order to craft high quality furniture and other items that will last, e.g. in the woodworking tradition. Here, as both Sellers (2015<sup>[9]</sup>) and Schwartz (2011<sup>[9]</sup>) argue, the embodied aspect of functional skill is connected to learning how to use affordable hand tools, rather than expensive machine tools that do the work for you.

### Aesthetic skill

As far as we can ascertain, aesthetic skill is not often mentioned in the history of craft, although it is important in the sense that the aesthetic value of crafted objects is often highlighted as a reason why craft and crafting are considered valuable practices. In our analysis, aesthetic skill refers to the importance of knowing how to craft beautiful products, for example in terms of being inspired by

By displaying knitting and embroidery in public spaces, "craftivists" claim that they make the world a better place. Greer (101<sup>[9]</sup>) argues that through craft you can creatively voice your opinions, which "makes your voice stronger, your compassion deeper and your quest for justice more infinite". One example of a craftivists product is the colourful knitted patterns that are found in public spaces, often together with a political message.

The educative purposes here are: (a) to take responsibility for the community and the environment, (b) to reclaim the handmade and (c) to make the world a better place, "stitch by stitch".

nature. Aesthetic skill is important in the arts and craft movement, in the sense that learning how to craft involves learning how to experience joy while crafting beautiful products. It is also found in the Swedish home craft movement and the expression of beauty in relation to heritage and old traditional crafts and patterns.

### Spiritual skill

In this context, spiritual skill does not mean religious aspects of craft and crafting. Rather, somewhat like aesthetic skill, spiritual skill refers to a learning content that transgresses concrete technical knowledge or utility-oriented functional skill. Spiritual skill thus refers to a learning content that involves knowing how to develop individual agency, which includes autonomy and well-being. This kind of skill can also be conceptualized as learning how to become who you are, as in the woodworker tradition, where knowing the 'real' craft is integrated with a sense of self. Spiritual skill also includes learning how to be playful, creative and innovative: all of which are highlighted in the makers- movement. Arguably, learning the spiritual aspects of crafting is accompanied by learning how to master data technology and electronics, as well as analogue skills such as building and soldering.

Moreover, there is an aspect of spiritual skill that concerns the intrinsic value of knowing how to craft, i.e. learning how to do it well for its own sake, regardless of function. However, spiritual skill is not limited to individualistic perspectives, but also involves learning how to develop compassion for others, the environment, growing together as a collective and how, in crafting, to be engaged in political activities.

Such social or communal engagement is also evident in the makers-movement, with its interest in learning how to share knowledge using open file standards. The idea is not just to learn for your own sake, but to share your knowledge with others, so they can also benefit from your creativity. In the purpose-based analysis, we have identified spiritual skill in all the craft waves except the Swedish home and craft movement, where it is not quite so evident. A final aspect of spiritual skill comes from the hippie movement, in which the willingness to make is an important skill content. Framed like this, this skill



content highlights that learning how to craft is for everyone and is not restricted to an expert.

### Etiquette skill

Although it is reasonable to assume that certain crafting etiquette is important in all the waves and practices of craft analyzed in this

study, etiquette skill is of special concern in the Swedish home and craft movement. Here, crafting is part of learning how to behave, i.e. the good behaviour of women is seen as a learning content of crafting. This form of skill can also be seen in the Swedish home and craft movement as developing what is referred to as good taste, which overlaps with aesthetic skill

## Approaches to learning

Drawing on the purpose-based analysis and the skill analysis, a number of ideas about learning in craft have been identified. In the discussion section we explain how the different waves of craft and their craft practices can be situated in the educational philosophy typology. However, at this point we would like to present some of the key learning concepts identified in the analysis. As in all learning processes, crafting involves categories of participants: learners, teachers and materials. The difference between the approaches to learning crafting are largely defined by who or how these categories are populated and interact.

### Expert-oriented learning

The expert-oriented learning approach appears throughout the history of craft and is based on the idea that certain crafting skills define the specific craft that is engaged in and that those practising the crafts need to learn. For example, Ruskin writes that “ten to one he thinks wrong; ten to one he makes a mistake in the first touch” (Ruskin, quoted in Sennett, 2008:133<sup>[9]</sup>), which signifies that if there is a wrong way there is also a right way. Hence, according to this approach, the craft expert is a necessary component in the learning of craft. The skilled expert is someone who can and will point out the right and wrong way to use the tools, treat the material and structure the process. Thus, arguably, an expert-oriented learning approach is present in both the arts and craft movement and the Swedish home craft movement. In the latter, a knowledgeable expert is needed who can guide Swedish women to learn the right skills, know what is beautiful and what constitutes good manners. Here, these categories are exemplified by craftswomen (experts and novices), local nature-based materials and the tools that are needed.

The expert-oriented learning approach can also be seen in the woodworker tradition, albeit in a lightly less authoritative way. Although this approach means learning from a knowledgeable craftsman or expert, the learning mainly takes place through the teaching/sharing of expertise on the internet. With respect to the identity of both learners and teachers/experts, the materials and tools used should be of good quality and durable.

The expert-oriented approach to learning is also present in craftivism when learning from others. This entails intergenerational learning, where craftivists learn from their grandmothers by reclaiming craft from domesticity and embracing new feminism

(Greer, 2008:13<sup>[10]</sup>) and from others on the internet. In many cases, the sharing of good techniques, materials and skills is a prerequisite for learning to take place. Using hash tags on finished items published online is a common way of connecting with other “teachers” and learners, mostly women, using yarn and the appropriate tools.

### Learning (or not) by doing

As the expert-oriented approach to learning can be seen as a continuum of an authoritative learning practice and a more collaborative and sharing learning practice, learning by doing indicates a more individualistic approach to learning. Learning by doing, which has been popularized in relation to how the writings of John Dewey have influenced formal, non-formal and informal education practices, involves less focus on the teacher/expert and more focus on the experiential knowledge or skill that is created in the process of trying, doing, failing, trying again, doing, failing again and so on. Thus, making mistakes is an important aspect of this approach to learning. According to Ruskin, learning the right way also takes time. Ruskin argues that it is the potential and realized mistaking that distinguishes man from a machine. Consequently, learning by doing sometimes overlaps with the more authoritative strand of the expert-oriented approach to learning crafting and can involve experts and novices and the use of “hand-size” nature material.

As it comes across in the maker tradition, the learning by doing approach means learning by doing it yourself. Seemingly alone, you try to do something, but fail in the doing. This is not considered a huge problem, in that the “learning by failing” approach is embraced. However, the maker version of this approach to learning also means that people can learn with and from others online by sharing their work and the mistakes they have made in the process. Although some women are involved in the maker movement, the majority of makers are men. Interestingly, in this specific version of learning by doing, the kind of material is irrelevant, although new technology, such as 3D printers, is often used.

A learning approach at the other end of the spectrum to that of expert-oriented learning is the kind of learning by doing that emerges in the hippie movement. This particular approach to DIY is based on the idea that everybody can learn and that expert knowledge of any kind is unnecessary, which also means that the quality aspect is tossed aside. What seems to be important here is that the crafting material is referred to as “natural” and its authenticity stems from



nature and is not refined. This can include wool used for knitting, or flax or hemp for macramé. Set in a context of increasing environmental awareness, this embracing of “natural” material can be seen as a response to the oil crisis and the abandoning of polyester yarn

(Lehnert, 2000:72<sup>[1]</sup>). The learning by doing approach and the environmental concern of the hippie movement is also shared by the earth catalogue movement, although the latter is not restricted to authentic natural material but also makes use of new technology.

	Purposes of craft	Desirable skills to achieve the purpose in question	Approaches to learning/ who and what participates
<b>1900 I:</b> arts and crafts movement	<ul style="list-style-type: none"> <li>(a) Provide the craftsman with joy</li> <li>(b) Have the expertise and skill to control the entire crafting process</li> <li>(c) Willingness to do something well for its own sake</li> <li>(d) Make the crafted item beautiful.</li> </ul>	<ul style="list-style-type: none"> <li>(a) Functional skill: crafting techniques, control of the whole process</li> <li>(b) Aesthetic skill: craft beautiful products</li> <li>(c) Spiritual skill: find joy</li> </ul>	<ul style="list-style-type: none"> <li>(a) Expert-oriented learning (experts and novices)</li> </ul> <p><i>Men, material from nature</i></p>
<b>1900 II:</b> the Swedish home craft movement	<ul style="list-style-type: none"> <li>(a) Make functional, durable and neat products</li> <li>(b) Make beautiful products</li> <li>(c) Educate Swedish women in good taste and behaviour</li> </ul>	<ul style="list-style-type: none"> <li>(a) Functional skill: crafting techniques, making functional, durable products</li> <li>(b) Aesthetic skill: good taste</li> <li>(c) Spiritual skill: good behaviour</li> </ul>	<ul style="list-style-type: none"> <li>(a) Expert-oriented learning (experts and novices)</li> </ul> <p><i>Women, local material from nature (+ silk and cotton)</i></p>
<b>1968 I:</b> the hippie movement	<ul style="list-style-type: none"> <li>(a) Political in its project to “go back to nature”</li> <li>(b) Become self-sufficient</li> </ul>	<ul style="list-style-type: none"> <li>(a) Functional skill: Willingness to craft</li> <li>(c) Spiritual skill: grow together as a collective</li> </ul>	<ul style="list-style-type: none"> <li>(a) The collective learns by doing</li> </ul> <p><i>Men and women, material from nature</i></p>
<b>1968 II:</b> “the whole earth catalogue” movement	<ul style="list-style-type: none"> <li>(a) Political in its project to become self-sufficient</li> <li>(b) Combines craft and technology with an ecological worldview</li> </ul>	<ul style="list-style-type: none"> <li>(a) Functional skill: creativity, innovation, ability to use tools, entrepreneurship</li> <li>(c) Spiritual skill: individual agency and autonomy</li> </ul>	<ul style="list-style-type: none"> <li>(a) The individual learns by doing</li> </ul> <p><i>(Men?), tools, technology and any material</i></p>
<b>2017: I</b> Woodworkers	<ul style="list-style-type: none"> <li>(a) Re-establish woodworking methods</li> <li>(b) Knowing woodworking as a whole</li> <li>(c) Create well-being</li> <li>(d) Become political by knowing how to woodwork (anti-consumerism)</li> </ul>	<ul style="list-style-type: none"> <li>(a) Functional skill: crafting techniques, control of the entire process, embodies woodworking knowledge and material awareness</li> <li>(c) Spiritual skill: well-being</li> </ul>	<ul style="list-style-type: none"> <li>(a) Expert-oriented learning (experts and novices) + sharing</li> </ul> <p><i>Majority men, good quality material</i></p>
<b>2017: II</b> “Makers”	<ul style="list-style-type: none"> <li>(a) Do what you love</li> <li>(b) Invent new stuff</li> <li>(c) Be creative</li> <li>(d) Share and support others</li> <li>(e) Become a more complete version of yourself as you make.</li> </ul>	<ul style="list-style-type: none"> <li>(a) Functional skill: creativity, innovation, ability to use the tools entrepreneurship</li> <li>(c) Spiritual skill: become who you are</li> </ul>	<ul style="list-style-type: none"> <li>(a) Learning by doing + sharing</li> </ul> <p><i>Majority men, technology and analogue making materials</i></p>
<b>2017: III</b> “Craftivism”	<ul style="list-style-type: none"> <li>(a) Take responsibility for the community and the environment</li> <li>(b) Reclaim the handmade</li> <li>(c) Make the world a better place</li> </ul>	<ul style="list-style-type: none"> <li>(a) Functional skill: know the handicraft</li> <li>(c) Spiritual skill: compassion for others, political activism</li> </ul>	<ul style="list-style-type: none"> <li>(a) Learning by doing / or from someone</li> </ul> <p><i>Majority women, yarn</i></p>

Figure 1 summarizes the findings of research question 1 - 3

## Discussion

This article seeks to identify what ‘crafting sustainability’ might mean in relation to ESD. A variety of purposes of craft have been identified in the three studied countercultures, including the desired skills connected to those purposes and a number of approaches to learning, such as what and who participates in the learning practices. But what are the implications of these findings for learning for a sustainable future, i.e. for ESD? Below, we discuss this fourth research question by (1) relating the four educational philosophies to the craft practices, visualized in Figure 2 and (2) highlighting some key implications for ESD.

Figure 2 illustrates the educational profile of our analysis of the different craft practices (Cf. Englund 1997:134<sup>61</sup>). Essentialism is in opposition to progressivism and points to the tension between an ‘expert oriented’ pedagogy and a ‘learning by doing’ pedagogy, and also with regard to a subject content in which certain facts, content and skills are treated as taken for granted in essentialism yet explored by followers of progressivism. The other tension illustrated in the figure is that between perennialism and reconstructivism. This tension indicates that the values and norms that are taken for granted in perennialism are continuously reconstructed in reconstructionism. This tension is sometimes interpreted as a time perspective, where the embracing of past traditions and values is contrasted with an unknown future that embraces innovation and new technology (even if new technology is not necessarily part of an unknown future).

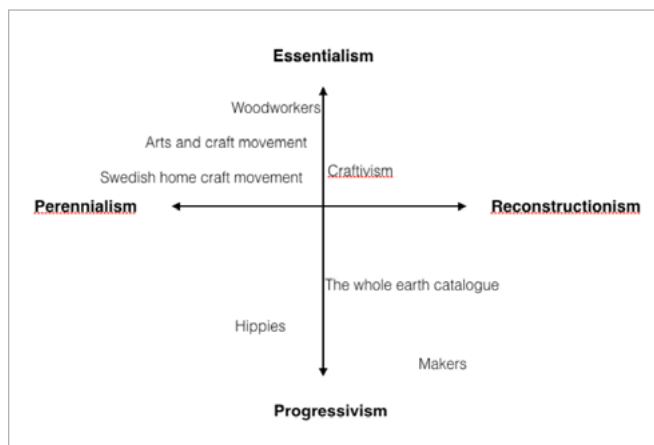


Figure 2. Illustrates the educational profile of our analysis of the different craft practices

As the above figure illustrates, the analysis shows that the arts and crafts movement, the Swedish home craft movement and the woodworker tradition are all influenced by perennialism and essentialism. Value-laden knowledge about good craftsmanship and the skills of functionality, spirituality and aesthetics are all present in these craft practices, as is to some extent also tradition and heritage.

Craftivism is more difficult to place in the figure. Our suggestion is that the movement has elements of essentialism, in that it stresses

the importance of learning specific craft facts when learning a handicraft and that craft should be open to anyone who expresses a willingness to learn. However, craftivism also has elements of reconstructivism, due to its explicit assumption that crafting involves political aspects in terms of creating a better world (although what a better world is, is not described in detail). Hippies, “the whole earth catalogue” and “makers” are all influenced by progressivism. Hippies are to some extent also influenced by perennialism due to the “going back to nature” element, whereas makers and “the whole earth catalogue” underline the importance of invention and embracing new technology, which, we suggest, places them closer to reconstructionism.

### Implications for ESD

A learner’s agency and capability to take action on environmental and sustainability issues is a capacity that is highlighted in ESD research. In our study, a learner’s agency is perhaps most obvious in the pedagogy of progressivism, due to its focus on learners’ experiences, which in the figure points to “the whole earth catalogue” and “makers”. However, an essentialist craft pedagogy could also be argued to contribute to a learner’s agency and capability to take action on environmental and sustainability issues, for example by knowing the whole process (a purpose in the arts and crafts movement), making long lasting products (argued to be a political act by woodworkers) or having the skill to mend and repair (as in the Swedish home craft movement, where functional and utility purposes are present). In fact, the study suggests that knowing craft can empower its practitioners and also that learners’ agency is present in all the craft practices that we have studied. In view of this, a relevant question to ask is whether learners are capable taking action on environmental and sustainability issues, and if so, which? If crafting empowers its practitioners, we can also ask, empowered for what? Our findings suggest that at least three tensions need to be taken into account when considering learners’ agency and an ESD craft pedagogy.

The first tension to be identified is the individual versus the collective. For example, one of the purposes of craft in the hippie movement is to empower “the people” – the collective. If we instead look at the “the whole earth catalogue”, the purpose of craft is to empower the individual. This tension has pedagogical consequences, depending on whether we are educating for an elite, or if learning craft is for everyone and for everyone’s benefit. It can also be argued that, as seen in the woodworker tradition, having general crafting skills and repairing or crafting long-lasting products is, in a neoliberal society, a political act of anti-consumerism. Another aspect of this tension is between the pedagogically privileged and under privileged. That is, to what extent can everyone learn to craft or produce long lasting products? Who is privileged to learn? To what extent is formal, non-formal and informal craft education available for everyone? A conclusion that can be drawn from this study, and related to the individual versus the collective





tension, is that each practice is (more or less) gendered. That the practice in 1900 is gendered is hardly surprising. Nevertheless, a stereotyped gender structure seems to continue throughout the history of crafting. For example, making things from yarn is female, and working with wood or technology is male. In other words, it is not just products that are crafted in each practice, but also identities. Suddenly, the purpose of craft is not just ideas. Rather, specific narratives of 'crafted sustainability' are embodied and materialized. When talking about an ESD craft pedagogy, it thus becomes crucial to ask what is included and excluded in an educative craft practice in terms of gender, class, race, environment and more-than-humans?

The second tension that is identified as having implications for ESD relates to the first tension but is slightly different, namely the embodied craft person's relation to the world s/he inhabits. The experience of joy is an example from the findings that exemplifies this tension. Expressing joyfulness when using aesthetic and spiritual crafting skills can be found in many of the examined practices. In the arts and crafts movement and the woodworker tradition, joy and well-being are experienced when the crafts-person is able to use his/her skills to do things "the right way" or to craft durable products with high quality materials. As experiences of joy and well-being are embodied experiences, at the same time as the very reason for having these experiences is connected to a prevailing discourse of what constitutes durable, beautiful or useful crafts, these enacted experiences are signs of a tension (or connection) between the intimately embodied and the social. Similarly, makers express joy and well-being when they do what they love to do, which is to invent new things. Craftivists express joy when they help or affect others with their craft. The embodied experience of joyfulness might be the same, but is achieved by means of different pedagogies and goals and always has some kind of broader, social or shared well-being on the horizon. In other words, there are different pedagogies of the body related to sustainability. Hence, the implications for ESD relate to how we learn to engage with, experience and alter the environment in which we live and, further, how this embodied experience, such as being enchanted, informs our reflections on and beliefs about the world (Shilling, 2016:57<sup>11</sup>).

## Conclusions

To close, this article is an explorative study that seeks to identify what 'crafting sustainability' could mean in relation to ESD. When examining craft's educative purposes, skills and approaches to learning, a variety of experiences and narratives emerge in relation to a possible ESD craft pedagogy. Thus, drawing on the studied craft practices, there are many possible implications for ESD, some of which overlap or reveal conceptual and other contradictions. Three

This can be discussed in terms of which sustainability issue the participant pays attention to as s/he experiences these positive affections. For example, the craftivists learn how to pay attention to the women that have gone before them and their skills, such as knitting, and further to pay attention to feminism and feminist research, the ideas of which they express through craft. Makers learn to pay attention to their own and other makers' creativity and innovation, whereas woodworkers learn to pay attention to the specific techniques and tools used by other skilful woodworkers. These are all examples of how the different countercultures imply that the creation of joyful embodied experiences is the key for learning how to craft and that each example points to different sustainability purposes. The tension of the embodied crafts experience and a person's relation to the world that is inhabited through craft points to a variety of sustainability futures.

The third tension to be identified is that between ecological, social and economic dimensions. A time perspective can highlight these tensions and illustrate how the dimensions have been valued over time in formal, non-formal or informal education. For example, a core argument in the arts and crafts movement was that as a craftsman's knowledge was no longer valued things could be made by machines, which cut costs and led to cheaper products. Although it is beyond the scope of this article to fully flesh out these arguments, it does seem obvious that there is a tension between the social (care for the craftsman) and the economic (produce cheaper products) dimension. Another example of this tension is that although the crafting of high quality products (with machines or hands) cost more, they are likely to last longer and, from a resource perspective, can be argued to be sustainable. We could give many more examples from the findings that point to different sustainability narratives. However, what we would like to emphasize here is the fact that what is being valued is also likely to be passed on through education. Which old craft traditions, if any, are valued and therefore taught and sustained in our Nordic societies today? Are mending and repair skills worth teaching, knowledge about crafting materials or rather a creativity as a matter of self-expression? The answers to these questions are complex and many, but what dimensions of ESD need to be reflected on when discussing crafting sustainability, and especially when discussed as an ESD craft pedagogy

specific tensions have been identified: (1) individual vs collective, (2) embodied experience vs. the world a person experiences and (3) ecological-social-economic tensions. All these tensions have implications for an ESD crafts pedagogy. Further, the purpose of any craft practice is more than just an abstract idea. It is an embodied and materialized narrative that needs to be considered if such narratives could be taught as a learning path for the future.



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# CRAFT MICRO-ENTERPRISES CONTRIBUTIONS TO SUSTAINABILITY

## *The Example of Yarn Related Businesses*

by Dr Alice Owen

*This paper uses two case studies of small UK-based yarn businesses to explore whether craft enterprises might make a distinctive contribution to sustainable development. The ways in which positive social, environmental and economic impacts are supported by these businesses are identified and their potential as niche sites contributing to a broader sustainability transition is considered. These businesses themselves believe there are strong links to the social dimensions of sustainability, particularly in terms of community building. There is also a distinctive contribution to economic aspects of sustainability with the outputs of craft enterprises releasing latent financial value and attaching value associated with provenance and rarity compared to a commodity market, rather than contributing to conventional economic growth. Contributions to environmental sustainability are largely indirect, through changing the economic viability of marginal agricultural production and therefore allowing conservation management in less economically favoured areas. This preliminary analysis suggest that the smallest craft enterprises do offer insights into how a wide transition might be achieved, but realising such a transition is made more difficult by the ambitions and motivations of the individuals in the craft businesses themselves.*

**Keywords:** *craft, yarn, micro-enterprises, sustainability*

**Author:** **Dr. Alice Owen**  
*Associate Professor in Business, Sustainability and Stakeholder Engagement  
Sustainability Research Institute, School of Earth and Environment, University of Leeds. UK*

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## Introduction

The purpose of this paper is to use the example of yarn-related businesses to explore whether craft enterprises, and specifically the smallest craft enterprises, make a positive and distinctive contribution. The simple partitioning of sustainability into a triple bottom line of economic, environmental and social impacts is used to explore the dimensions of any such contribution. This purpose is situated within the multi-level perspective of transition management. The case studies presented and analysed are being explored to assess whether they offer niches for innovation which might spread further, affecting a transition to greater sustainability where business success is co-dependent on generating environmental and social value, rather than achieving financial success at the cost of social and environmental value. The case studies presented in this paper demonstrate that the business of craft contributes to the economic and, indirectly, to the environmental dimensions of sustainability, and micro-enterprises in the business of craft make a distinctive contribution to the social dimension of sustainability. No major negative impacts of these businesses on sustainability are identified.

Three aspects of the paper's scope require clarifying at the outset; what is meant by 'craft', 'yarn businesses' and 'micro-enterprises'?

In this paper, using the term 'craft' is intended to mean deploying skilled labour to shape physical materials creating a unique item. Craft here is 'creative' in that applying those skills to achieve a desired outcome requires innovation and problem solving. Equally, craft is 'technical' in that materials must be handled in specific ways in order to function as required in the crafted object. Craft activities operate along a gradient from fully professional to hobbyists.

'Yarn businesses' covers a range of yarn-related enterprises. Creating crafted objects from fibre may be the commercial activity (e.g. the production of knitted sweaters or felted ornaments), or micro-enterprises might support craft as a leisure, DIY activity (e.g. dying yarn which is then used by the customer to create a sweater). This seems appropriate given the economic value of craft supply is much greater than that of craft production (Luckman, 2015a<sup>[9]</sup>). The scope of textile craft micro-enterprises considered here is that they participate in the chain 'from fleece to garment'. While wool is not the only fibre used in yarn businesses, it is a helpful illustration of the different enterprise activities in this sector. Fibre is spun into yarn or felted, dyed, and used to create a crafted object through knitting, crochet or weaving. Spinning, dying and fibre use are all processes which can be carried out by micro-enterprises, usually with other larger scale enterprises

carrying out similar functions using common elements of the supply chain and providing products to meet different customer needs. In addition to this linear conception of the supply chain, there are also satellite enterprises that might also be considered to contain elements of craft, such as pattern design and preparation. Yarn businesses often carry out more than one craft activity, e.g. for example combining spinning with dying (with retail). While this paper focuses on the smallest enterprises, economic activity of yarn production and sales in the UK has a core of large, long established firms buying fleece through the commodity broker British Wool Marketing Board and spinning yarn for both DIY and commercial manufacture use in a range of mills across Europe. However, as craft has (re)emerged and knitting/crochet have been reclaimed by some as fashionable activities supported by IT platforms which connect a geographically dispersed community of enthusiasts, a new niche has opened up in micro-enterprises (Luckman, 2015a<sup>[9]</sup>). The case studies below start to explore that niche. The case study enterprises carry out activities 'from fleece to materials ready to make a garment', together with associated activities of design and customer support for making. One case study is a collaboration between dyer and designer to source single breed yarns offered through a subscription club. The other case study works with several farms to produce a custom blend of yarn which is dyed and collated with other materials to make craft kits.

The definition of 'micro-enterprises' used in this paper is the one adopted by the EU: ten or less employees and a turnover below two million euro. In practice, the enterprises providing the empirical data for this paper are much smaller, three employees or less. However, these micro-enterprises often collaborate, forming larger virtual enterprises, to achieve shared or complementary goals, while each retaining a separate economic footprint.

The structure of the rest of this paper is as follows: the next section provides some context by describing how contributions to sustainability can be classified and common conceptions of sustainability in business. This is followed by a short description of the method and longer descriptions of the two case studies. After the findings from the case analysis, the discussion section reflects on whether these businesses might form niches of innovation with the potential to trigger wider change. The conclusions situate the key findings – that craft micro-enterprises can make a distinctive contribution to sustainability, particularly in terms of releasing latent economic value and in generating social capital – in the broader context of whether this contribution can be part of a wider transition to greater sustainability, and then offers avenues for further research.

## Context: sustainability, business and transition theory

To provide some structure for the exploration of how craft micro-enterprises contribute to sustainability, a 'triple bottom line' model

is used (Elkington, 1999<sup>[10]</sup>). While this model has been criticised as simplistic or impossible to operationalise (Norman and MacDonald,





2004<sup>[6]</sup>) it does provide an accessible way to open up the impact of craft micro-enterprises beyond their simple economic or employment contribution.

**Economic** – most readily measured in terms of “gross domestic product” (GDP), an increased level of economic activity does not necessarily imply greater contribution to sustainability. Increasing spend on environmental remediation or health care for chronic respiratory disease contributes to increasing economic activity, but the more sustainable outcome would surely be not to have to finance these activities but rather to remove their cause? Craft micro-enterprises will make some contribution to GDP, but their contribution to the economy might also be by allowing people to enter the economy through flexible working or by adding value to a commodity.

**Environmental** – this area of contribution is mostly concerned with the environmental impacts of production and consumption. What materials are used by craft micro-enterprises and how are they used, with what environmental effect? In terms of consumption, what are the environmental effects of using, and eventually of disposing of the products of craft enterprises? In considering this area, the factors that influence materials selection and use also need to be drawn into the picture.

**Social** – relevant to this paper at both the individual and community scale. Does a craft micro-enterprise offer benefits to individuals in terms of their health and well-being (the individuals evaluating this could be the business person or the customer)? And do micro-enterprises contribute beyond the individual level to the quality and cohesion of their communities or neighbourhoods?

One of the limitations of using this structure is that while the idea of a bottom line implies that there can be positive and negative impact (or benefits and disbenefits), in practice there is no baseline established against which positives and negatives can be measured. This limitation is recognised in the thematic analysis described in the method, below.

While both the terms “enterprise” and “business” are used interchangeably to some degree, it is worth noting that exploring “enterprise” rather than “business” indicates several possible organisational purposes i.e. profit or non-profit, whereas business will imply a profit motive. In terms of how sustainability is addressed in and by business, the role of business in contributing to sustainability is often viewed as driving resource efficiency and doing more with less. This has been developed further to include concepts of social benefit and capital, using enterprise to generate “shared value” (Porter and Kramer, 2011<sup>[6]</sup>) with both producer and consumer receiving benefits. In shared value, the underlying assumption is that the enterprise still generates financial value, but in doing so it generates social or environmental value for its customers. In this paper, the potential for economic, social

and environmental value is considered for both suppliers and customers.

Economic and social benefits also intersect in the concept of the “bottom of the pyramid” where business can support sustainability and be profitable by providing goods and services to the poorest in society, often suggested in the context of developing economies (Prahalad, 2009<sup>[6]</sup>). The context in which this theory is developed is very different to the context of the case studies presented here. ‘Bottom of the pyramid’ strategies aim to meet social goals through the alleviation of poverty, and economic impact. The case studies presented here are representative of sector which does not have the primary aim to meet basic needs for the owners or the customers.

Instead, the examination of these case studies and their contribution to a triple bottom line is couched within the theory of transition management, and specifically within the “multi-level perspective” (Geels, 2002<sup>[6]</sup>). This paper’s interest in craft businesses extends beyond whether they are sustainable enterprises, to whether they might form part of a transition to a more sustainable economy. The multi-level perspective offers a framework where niches of innovation are set within in a particular socio-technical regime, operating in a landscape of policy, society and available resources. A successful niche innovation may eventually succeed in altering the regime that sets the rules for success (Geels, 2002<sup>[6]</sup>). This perspective has been powerful in understanding technology-led transitions and has been used to examine ways in which a regime might be shifted to achieve more sustainable outcomes. Further work by Geels and Schot (2007<sup>[6]</sup>) identified four possible pathways for niches to spread into wider regime-level norms. Working with historical examples of where technology has driven system-wide transition, the four pathways suggested are “transformation, re-configuration, technological substitution, and de-alignment and re-alignment” (Geels and Schot, 2007<sup>[6]</sup>). The rise of craft businesses from interesting niche to a wider pattern of economic activity would be closest to the “reconfiguration” pathway, although what is changing is not the technologies of making; the fundamentals of yarn production and use remain as they have been, in essence, for centuries. Rather the purpose of the technologies used and the outcomes from using them are changing. Objects crafted from the products of yarn micro-enterprises are fulfilling multiple goals for both the yarn producer and consumer/customer, and business is conducted in different ways that reflect these complex objectives. Despite the technological continuity in yarn businesses, the multi-level perspective is being applied here to consider small craft businesses as innovators in the way in which they do business. Does their approach to enterprise lead to different outcomes and different contributions to sustainability, compared to the conventional economic-growth driven way of doing business? From the case studies described below, we can start to label the distinctive contribution that such businesses make to sustainability, and reflect on how these ways of doing business might move from niche innovations to regime level norms.).



## Method

The two exploratory case studies are largely based on secondary data sources (mainly web-based and social media) plus primary data collection from interviewing the entrepreneurs who lead each case study, clarifying or expanding on information sourced through on-line scoping. Data was collected by a crafter (and enthusiastic knitter) and while the resulting potential for bias is acknowledged, this is countered by the benefits of the common technical language of craft practice shared by the interviewer and the entrepreneurs, together with the way in which that shared enthusiasm opened up access to data. The case studies were selected purposively, using the criteria of on-line presence; the business providing a main income; yarn as a core product; and use of bespoke or traceable supply chains. Parallel mapping research still under way suggests that there are hundreds of similar enterprises in the UK and the two case studies presented here do not appear to be outliers, although no robust claims are made for their representativeness. Rather, the case studies present different facets of the ways in which

micro-enterprises can operate in the sector. Cross case thematic analysis and comparison was carried out, examining the ways in which the two different businesses made contributions to sustainability in the dimensions of the triple bottom line. As recognised in the description of the triple bottom line, there is also a bias in the case studies towards positive impacts or the benefits that the case studies offer to sustainability, with the underlying assumption that these benefits are in contrast to a baseline which is "business as usual". This further implies that "business as usual" needs to be described and forecast for a rigorous assessment of the changes if a more 'sustainable' approach is taken. For this exploratory analysis, no such baseline is established. The case studies do, however, highlight practices and impacts which are not part of 'business as usual' as carried out by larger, commodity-based, yarn businesses. While no direct negative impacts from the micro-enterprise activity were identified from the case study data, it must be recognised that such disbenefits may exist.

## Case study 1: Neighbo(u)rhood Sheep Society 2016

The Neighbo(u)rhood Sheep Society 2016 (NSS2016) was a three-part yarn-and-pattern club run by an independent dyer YME1 in collaboration with designer YME2. YME1 also runs a bricks and mortar yarn store in a city, retailing a range of yarns from large and small enterprises, and providing classes and a social network for knitters. The store's products are also available through an online shop run as part of the store's website. NSS2016 was the third time this pair of micro-enterprises had collaborated. Customers paid in advance for a series of yarns together with newly designed patterns that used the yarn. The international reach of this project is signalled by the use of both UK and American English spellings in the club title. A notable feature of NSS2016 was its focus on single breed yarns. Different sheep breeds produce fibres of different thickness, length and colour. This affects the properties of yarn that those fibres are spun into, in both the yarn's ability to take colour, and the way it performs when turned into a fabric. Each instalment of NSS2016 featured one, or sometimes two, different sheep breeds, with the fibre commercially spun and then dyed by YME1. Thus both YME1 and YME2 had to understand the properties of that instalment's yarn and deploy their expert craft skills in dyeing and designing so that the final product, as crafted by the club members, would be functional and attractive. Each yarn club instalment had a slightly different supply chain, with YME1 working directly with flock managers in different UK locations, using the same mill for spinning each batch.

Each club yarn instalment was supplied with a download code which gave club members access to a specially designed pattern

via the 'Ravelry' platform. Ravelry is 'facebook for yarn', a micro-enterprise itself employing five people in the US. Founded in 2007, Ravelry now has more than seven million members and acts as social network, personal record of projects, pattern database and yarn database. YME2 has around 100 patterns for sale via Ravelry and also offers teaching in addition to collaborating with dyers. There were 65 NSS club members in 2016, across three continents. Each member paid approximately €150 for three instalments over five months. A forum, co-moderated by both YME1 and YME2, on Ravelry offered a way for club participants to 'chat' about the club packages and their making progress, as well as showing off their finished projects. This forum indicates that both YME1 and YME2 operate in an on-line community with international participation. YME1's website includes blog entries from both enterprises and the tone of communications is personal.

NSS16 was part of a broader picture of micro-enterprise collaborations based in and around the city where YME1's store is located, including a Yarn Festival and a Yarn Crawl, which aim to generate greater retail sales for all independent craft retailers in the city. This indicates that YME1 has a strong presence in a spatially defined crafting community as well as reaching internationally through Ravelry and projects such as NSS2016. The skillsets of the two entrepreneurs are important in placing these enterprises within a social network; as practitioners rather than 'only' a business, the entrepreneurs are peers with their customers.



## Case Study 2: Yarn producer and retailer's flower brooch series

LYME<sub>3</sub> operates from a small village in a deeply rural location in the north of England where sheep farming dominates agricultural activity. It is run by a married couple. YME<sub>3</sub> combines retailing mass-produced items for knitting or crochet with its own line of yarn – a blend of fibres from farms in the north and south west of England, spun at a mill in Yorkshire. YME<sub>3</sub> has developed its own supply chain, combining fibres from at three different farm producers and co-ordinating spinning via a small mill, as well as colour palette design and dyeing the fibre. The two strands of YME<sub>3</sub>'s retail business (mass produced and unique) come together in kits at a range of price points to make knitted bags, cushions, brooches and other accessories. The knitted flower brooch kit comprises less than ten grammes of yarn, together with a button, brooch pin and pattern, packaged together in a cardboard case measuring less than 6cm square and retailing for approximately €8. There are seven variants of the kit, each with a different design, button and

yarn combination. The customer can then create, if they have basic knitting skills and the needles not supplied in the kit, a brooch in the shape of a flower. YME<sub>3</sub> also sells wooden items produced in Weardale by another rural craft microenterprise and aimed at the yarn crafter.

YME<sub>3</sub> sells its products online through its own web shop rather than using Etsy or another platform. YME<sub>3</sub> does not have a highly visible presence in the online craft communities supported by Ravelry. The website does not support a blog or profile the people behind the business. YME<sub>3</sub> also retails its products at festivals and events which promote rural business and yarn crafting. At such events, the smaller value items which offer a complete project for the crafter, such as the flower brooch kits are extremely popular and YME<sub>3</sub> frequently sells all the stock of brooches or ornament kits that it takes to such retail events.

## Findings from case analysis

The attributes of the two case studies are now explored under the three elements of the triple bottom line.

**Economic impacts:** both case studies offer an economic contribution in unlocking latent value of a commodity (raw wool from fleece). When put into the centralised commodity market, wool has a very low value in cents per kilo. Separated out from that centralised value chain, retaining the 'identity of breed and provenance, these micro-enterprises are able to distribute value differently along the supply chain with a value in the finished item (processed yarn ready for craft use) hundreds of times higher per kilo. This latent value is released by making provenance visible. Location, breed or flock/farm specific information is part of the product information. Both case studies also highlight the way in which micro-enterprises deliberately involve other micro-enterprises (such as designers or craftspeople), and occasionally SMEs (such as spinning mills) in that new value chain.

The notion of providing good work for individuals also fits into a consideration of the economic contribution of these yarn businesses. Good work here means work which provides intrinsic benefits, to an individual or a community, rather than work whose sole purpose is to provide income. Thus the practice of craft as a business activity provides different rewards for the entrepreneur compared to the business activities of other small businesses, such as, for example, web design or consulting. All the individuals in these case studies display curiosity, excitement and professional pride in their work, describing the satisfaction of craft work. The work that these individuals undertake is not only the means to an end (income), it also offers rewards in the doing of the work itself.

The individuals in these case studies also expressed a desire for self-determination in creating their own patterns of work and activity. This affects both the craft practiced, where a craftsperson makes products for which they have the skills, knowledge and resources, and the forms of enterprise in which the craft is practiced. The choice to be self-employed, or a sole trader, or part of a flexible micro-enterprise is deliberate. The ostensible lack of security of employment is balanced against the opportunity to select projects that individuals want to work on, and people (customers and collaborators) with whom they wish to work, in flexible working hours, in locations they want to work in. The issue of working hours is particularly visible; practitioners in micro-enterprises design their work with flexibility around caring responsibilities, school hours and holidays and so on. Once relationships are established, the location of individuals is not critical. YME<sub>2</sub> moved from the UK to Australia during the case study period and remains an active part of that enterprise network.

Importantly in terms of a contribution to sustainability, none of the case study micro-enterprises have economic growth as their main motivation. Although YME<sub>1</sub> and YME<sub>3</sub> would both like to grow their economic activity a little, this is bounded by wanting a sufficiency to live well, but not to take on the responsibility of employing others. By contrast, the variety of levels of income from textile craft enterprises is wider. While for some yarn businesses, notably retail or dye studios, the business is the primary source of income, for many more income from the craft enterprise is a second or top up income. This sector is female dominated, thus any craft-related income is often- although by no means always - considered supplementary, a way for an individual to ensure ongoing economic activity while also balancing other needs and expectations such as home making or caring responsibilities (Luckman, 2015a<sup>[9]</sup>).



Environmental impacts: both case studies claim a secondary link to environmental benefits through procuring their products (yarn) from specific farms or habitats. The case study products improve the economic viability of rare breed or conservation grazing i.e. agricultural practices that enhance biodiversity. There may also be a direct link to environmental benefits through the use of 'natural' dyes, particularly by YME1, although to what degree the dyestuffs and the dyeing technique in combination can be claimed to be lower in environmental impact than the use of synthetic dyes does require further evaluation before the claim is fully supported.

Social impacts: both case studies make claims to the importance of community in developing their businesses, although this is much more visible for YME1 and YME2 who put considerable effort maintaining an international community of customers and collaborators, while YME3's community is more transient, brought together for a festival or fair but potentially not becoming active again for a year until the festival comes around again. A thriving community of users may not be the same thing as a thriving community, but the individuals in these case studies reported a sense of belonging and community as something that felt important to them. The idea of community is entangled with location and place most clearly for YME1.

These yarn businesses undertake community building activities along their supply chains, as part of developing a market for craft. In effect, the final part of the supply chain, the labour of production in producing the garment or other crafted item has been exported. The customer is also a producer. Community building activities include: podcasting, teaching (on line or face to face), 'trunk shows', yarn festivals, craft fairs, and farmers' markets as well as

Ravelry activities. These activities rely on the yarn business developing multiple relationships and becoming part of a wider community with many collaborations at different levels. Collaboration may be in fibre selection, product design or product aftercare, as demonstrated by activity on discussion forums where customers can suggest new ideas for product variation or use.

The role of the yarn business in supporting, and re-inventing, tradition is also a common theme with societal impact. By displaying the provenance of their yarn at all, both case studies demonstrate that distinct spatial identities (e.g. wool from a Scottish croft or a farm on the fringes of a protected landscape) form the basis for co-operation and product promotion.

As well as these contributions to, and dependence upon, communities, the yarn businesses in these case studies also claim a contribution to individual health and well-being, for both the entrepreneurs and their customers. Practicing yarn craft offers benefits for mental health (Corkhill, 2014<sup>[9]</sup>) as well as supporting skill development as an aspect of personal growth. However, this is not necessarily a distinctive contribution from micro-enterprises, since crafting with cheap acrylic yarn bought from large chain stores may deliver similar benefits to crafting with expensive artisan yarns with single flock provenance purchased from micro-enterprises. Increasing individual craft knowledge and skills is intertwined with the community-building aspects of the yarn business activity, where skills are acquired through social networks and personal connections (real or virtual). Yarn craft skills can be passed on through generations and can offer some sense of family or community identity (Abrams, 2006<sup>[9]</sup>).

## Discussion

Reflecting on the framework of the multi-level perspective offered by sustainability transition theory, is the innovation that these small yarn businesses are driving a niche activity that might break out and change the wider regime that surrounds it? Niches can provide the basis for strategic change in a socio-technical system (Geels and Schot, 2007<sup>[9]</sup>) but this requires both an understanding of the transition sought, and a protective space for the niche actors to flourish and expand into the broader regime, and landscape (Kemp et al, 1998<sup>[9]</sup>, Smith and Raven, 2012<sup>[9]</sup>). The case study businesses are deploying innovation in business models rather than the technology of making, but this is still innovation that offers a contribution to sustainability. These business models offer the entrepreneurs benefits other than economic growth. Could this niche lead to further transformation, a regime-level revaluation of craft and craft materials to counter the economies of scale and commodification that have dominated methods of production since the industrial revolution? Some yarn microenterprises have a desire for a broader transition as part of their aim, e.g. to increase the visibility and value of fibres with provenance and connections to conservation values, but these case studies do not suggest an innate drive

towards transition of the wider economy; they would not use protective spaces (Smith and Raven, 2012<sup>[9]</sup>) to grow far beyond their current niche and make a wider change. There is no evidence that growth, beyond a comfortable livelihood and fulfilling work life, is sought by craft enterprises such as those described here. Craft micro-enterprises are concerned with earning a living, but growing the economic footprint of the firm, taking on employees and so on can be a disincentive, taking the craftsperson away from their core interest of practicing their craft. This is by no means a uniform situation and it has also been observed that the increased focus on craft as a trend can lead to craft entrepreneurs prioritising brand building and marketing while outsourcing the physical practice of craft (Luckman, 2015a<sup>[9]</sup>). Data collected internationally from craft micro-enterprises suggests there might be a 'handmade' economy emerging (Luckman, 2015a<sup>[9]</sup>), but that this is not sufficiently robust to provide a full income for craft practitioners (Jakob, 2012<sup>[9]</sup>).

The most distinctive contributions from yarn micro-enterprises arise where the different forms of sustainability impact intersect. Environmental and economic benefits overlap in the focus on



fibre provenance, breed-specific fibres and conservation grazing. These micro-enterprises are deliberately improving the viability of their small fibre suppliers by offering a route that takes fibre out of the commodity value chain. In parallel, the small fibre suppliers managing rare breed flocks are often based in locations where the landscape and conservation values are highly prized, but agricultural productivity is marginal. Similarly, social and economic benefits overlap in community building where, by offering social benefits through supporting a community of craft practitioners, micro-enterprises also grow the market for their products, and for similar products from other micro-enterprises. Another example of mutually reinforcing social and economic benefits lies in how yarn businesses can be configured to allow individuals to enter the workplace on their own terms with flexibility and self-determination. This connects to the historical perspective on the role of gender in place-specific yarn enterprises, and the changing value of work done in the home for internal or external consumption (Abrams, 2006<sup>[9]</sup>). This historical analysis brings to light a web of complex economic arrangements and different forms of collaboration and interdependence which has echoes in today's yarn businesses.

Also at the individual level, social and economic benefits are very closely related in the way that the entrepreneur undertakes their work. A useful differentiation between businesses which are practice-oriented and practices which are business-oriented comes from the rather different field of design and architecture (Coxe et al, 1986<sup>[9]</sup>). The case studies here seem to have a stronger sense of being practice oriented i.e. the business is a means of supporting craft practice rather than being business-oriented, where craft practice would be a means to generating an income first and foremost. Coxe et al. (1986<sup>[9]</sup>) also indicate that the focus of a firm also

appeals to distinct sets of customers. Small yarn businesses such as those described in the case studies connect effectively to a distinct group of customers, enhanced by their on-line and community building activities, but this is only a subset of all yarn customers. Related to this, a survey of small manufacturers of clothing and textiles with similar characteristics to the case study enterprises in their size, activity and markets found that the motivations of the business owners covered a variety of needs including physiological, safety and emotional needs (Stoll and Ha-Brookshire, 2012<sup>[9]</sup>) which suggests that there is no simple model of the yarn business entrepreneur's motivation.

A final point to note here is that the economic and social contributions to sustainability from these micro-enterprises rely on information technology (IT). The way in which both case studies operate would not have been possible prior to widespread use of the internet, the development of secure online shopping platforms and, in the case of YME1 and YME2, the development of the industry-specific platform, Ravelry. IT enables collaboration (supporting the social contribution of these firms) and provides access to markets for the results of those collaborations (supporting the economic contribution). Ravelry's forums contain many examples of 'knitalongs' where a designer and yarn supplier collaborate and provide incentives and support to customers to work on a project. Collaboration in the textile micro-enterprise sector makes use of crowdfunding, which is only possible due to developments in information technology. Crowdfunding platforms are frequently used to provide capital for yarn production, for books of designs linked to specific yarns, for dye studio equipment or for retail space. In addition, retail platforms provide even the smallest businesses with access a new customer base, ways to promote products, identify collaborators and provide customer support (Luckman, 2015b<sup>[9]</sup>).

## Conclusions

These two case studies suggest that there are contributions that the smallest yarn businesses can make to sustainability, particularly in the economic and social elements of the triple bottom line. These contributions are distinctive, reflecting both the micro nature of the businesses and the craft focus of those businesses. The two case studies briefly presented here only suggest the nature of these contributions. Analysis of a greater number of small yarn businesses working from different locations and targeting different market segments and their impacts would help to develop a better understanding of the attributes of craft and small business that drive the production of these benefits. What is it about yarn crafting that enables micro-enterprises to reach back along the supply chain and release latent value as well as supporting environmental benefits while at the same time building individual social capital through skills development or community social capital?

If it is accepted that a micro-enterprise's business approach is an innovation, with parallels to the more usual conception of innovation

as changes in technology, then the challenge becomes how to think about spreading that innovation more widely. Transition management theory and the multi-level perspective offer a way to focus on how a niche activity can expand towards a mainstream, or regime-level, set of norms. Expanding to influence the regime level could increase the scale and impact of these small businesses' contributions to sustainability. However, there are severe limitations on how well the case studies here represent the kind of strategic niches that lead to wider change. Small craft businesses may wish to remain small and niche. This does not mean they are isolationist; a tapestry of micro-enterprise activity is interwoven with the activities of big enterprises, particularly upstream in their respective supply chains. Dozens of artisan yarn and textile brands exist, but mass-produced fibre, yarn, accessories and garments account for most market share. Given that these larger firms operate comfortably within the existing regime level, with well-established technologies, business models and retail channels, the dependence of the small firms on what larger firms provide, would suggest





there is limited motivation or interest in the niche innovations of the smallest businesses spreading much beyond their current sphere of influence. Neither does this desire to stay within a niche imply a lack of innovation in the micro-enterprise. While the core “technologies” of spinning and textile manufacture have been in existence for centuries, the innovation in craft product design and in the craft supply chain is extensive.

If the multi-level perspective does not offer a perfect fit for understanding the potential for the smallest craft businesses to contribute to sustainability, what other theoretical framings might be useful? Two possible avenues for further research are suggested. First, actor network theory (Latour, 2005<sup>[9]</sup>) reminds us of two important ideas: no-one acts alone, and objects also have agency in networks. Systematically applying the ideas of actor network theory to craft enterprises might reveal where agency to effect sustainable outcomes is located. Situating the enterprises delivering a crafted project within a ‘community of practice’ (Wenger, 1998<sup>[9]</sup>) might also help to analyse how such a community might be developed in order to contribute to sustainability. A communities of practice focus might help to identify the processes through which a group of craftspeople might accelerate their learning and create positive impacts from their work.

From the outset of this paper, no claims are made for a fully worked out theory of craft, enterprises and sustainability. Rather, the paper has sought to bring into discussion micro-enterprises as a location for yarn craft activity which makes a contribution to

sustainability both for individuals and for communities, as both consumers and producers, of fleece, yarn and crafted objects. Individually small by definition, and certainly diverse, collectively micro-enterprises matter as the context for thousands of practitioners to practice their craft skills. Micro-enterprises present an as yet unrealised opportunity to transform the impact of craft activity and make a unique contribution to transitions towards sustainability.

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### Biography

Dr Alice Owen is an Associate Professor of Business, Sustainability & Stakeholder Engagement in the Sustainability Research Institute at the University in Leeds, UK. She became a social scientist and academic after two decades of experience in business and public policy at a variety of scales in the UK. Research into the practices of small firms that dominate the construction industry has led her to be interested in micro-enterprises more generally. She is also a knitter, `ravname Alicejeffcott`.

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## *Crafting Connection Through Plant-Relating Arts-Science Experiences of Urban Ecology*

by Dr. Tanja Beer & Cristina Hernandez-Santin

*Various platforms have demonstrated the value of hands-on activities – such as community gardening and crafting – in making meaningful connections and collective identities for a sustainable and resilient future. In his seminal book, *Flow: The Psychology of Optimal Experience* (1990), psychologist Mihaly Csikszentmihalyi describes how these activities can be an opportunity to engage with ‘flow’ – a highly focused mental state that increases awareness, connectivity and well-being. In *Through Vegetal Being* (2016), philosophers Luce Irigaray and Michael Marder also argue that it is through ‘vegetal’ (or plant relating) activities in particular (e.g. touching and smelling plants), that our relations with the more-than-human world can be reignited. Drawing upon these publications and others, this paper explores how combining these two modes of thought – to enable ‘flow’ through shared ‘vegetal’ or plant-based activities – may assist communities in gaining a greater awareness of and connection to sustainability. The potential of plant-based creative activities are examined through a recent, practice-led, arts-science research project (Refugium WA, Australia 2017), which used scientific knowledge and ‘vegetal’ or ‘botanical’ crafting as a way of engaging people in biodiversity issues. The project employed the community in creating mini native plant-sculptures which were temporally installed at the State Library of Western Australia. Indication of flow, increased nature-connection and biodiversity understanding were explored through gathering observations of the participants, pre- and post-activity surveys and discussions. The research sought to examine the capacity for vegetal-crafting activities to lead to new modes of arts-science communication that connect people to the importance of biodiversity in urban spaces.*

**Keywords:** *craft, sustainability, arts-science communication, flow, vegetal being.*

**Authors:** **Dr. Tanja Beer,**  
*Academic Fellow in Performance Design & Sustainability (Ecoscenography)*  
Melbourne School of Design, The University of Melbourne, AUSTRALIA  
**Cristina Hernandez-Santin**  
*Research Assistant, Thrive Research Hub*  
Melbourne School of Design, The University of Melbourne, AUSTRALIA

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## Introduction

In a society where people are becoming increasingly urbanised, it is clear that we need new strategies that connect communities to their local ecologies and motivate them in the hands-on co-creation of a thriving future (Bennett and Beudel 2014<sup>[1]</sup>). Disconnection from nature is a significant consequence of contemporary society. Since the rise of the industrial revolution, our rapidly changing urban environment and lifestyle has created an understanding of nature as 'out there' or as something separate from ourselves (Bateson 1972<sup>[2]</sup>; Næss 1984<sup>[3]</sup>). In recent decades, there has been a substantial decline in people engaged in nature-based recreation, due to the increasing value placed on passive screen-based entertainment (Pergams and Zaradic 2006<sup>[4]</sup>; Kesebir and Kesebir 2017<sup>[5]</sup>). Disconnection from nature has not only led to an array of physical and psychological issues, including obesity and attitude, cognitive and developmental problems (Mustapa et al. 2015<sup>[6]</sup>), it has also been linked to a decrease in environmental awareness and a lack of concern for conservation issues (Wells and Lekies 2006<sup>[7]</sup>; Kareiva 2008<sup>[8]</sup>). This presents significant challenges for the future preservation of our natural environment.

Numerous commentators have argued for the value of the arts to inspire the public on environmental issues (Lesen et al. 2016<sup>[9]</sup>; Heras & Tabara 2016<sup>[10]</sup>; Thomsen 2015<sup>[11]</sup>; Evans 2014<sup>[12]</sup>). In particular, research suggests that collective learning through participatory arts (where audiences become collaborators or co-creators of the art) can produce meaningful change in pro-environmental behaviour (Curtis 2009<sup>[13]</sup>). For example, various platforms have demonstrated the value of hands-on activities – such as community gardening and crafting – in making meaningful connections and collective identities. In his seminal book, *Flow: The Psychology of Optimal Experience* (2008<sup>[14]</sup>), psychologist Mihaly Csikszentmihalyi describes how these activities can be an opportunity to engage with 'flow' – a highly focused mental state that increases awareness, connectivity, and well-being. In *Through Vegetal Being* (2016<sup>[15]</sup>), philosophers Luce Irigaray and Michael Marder also argue that it is through 'vegetal' (or plant relating) activities (e.g. touching and smelling plants), that our relations with the more-than-human world can be reignited.

Drawing upon the above publications and others, this paper explores how combining these two modes of thought – to enable 'flow' through shared 'vegetal' or plant-based activities – can connect people to nature through hands-on creative experiences. Using a practice-led research project (Refugium WA, Australia 2017), the paper draws upon our observations of how vegetal crafting may become a conduit for linking people to the importance of biodiversity in urban spaces. The research was assessed using a pilot research design of pre- and post- activity surveys, including self-reported measures of flow, levels of nature connection and understanding of Perth's biodiversity. Qualitative and quantitative measures were also paired with the researcher's observations, reflections and participant discussions to help gain a holistic understanding of the study.

To help clarify our research, we consider four key concepts within the context of this paper: 'craft', 'nature', 'nature experience' and 'sustainability'. Firstly, we apply Sarah Kettley's (2016<sup>[16]</sup>) contemporary understanding of 'craft' which is focused on collaborative creativity and potentiality, including the continuous capacity for authentic and rewarding personal and collective engagement. Secondly, we define 'nature' as a series of interconnected ecological relationships, of which humans are a part, rather than a separate entity that exists outside or separate to ourselves. Nevertheless, we also acknowledge that the concept of 'nature' can be ambiguous and can result in a variety of understandings for different people. Thirdly, we consider Freeman and Tranter's (2011<sup>[17]</sup>) categories of 'nature experience' which recognises that encounters with nature can occur in three different ways: 'direct', 'indirect' and 'observation without contact'. According to the authors, 'direct experience' implies physical contact with nature through play or immersion within natural environments. Conversely, 'indirect' contact corresponds to understandings of nature obtained through various secondary mediums (e.g. scientific books, photography, nature documentaries). 'Observation without contact' corresponds to passive experience of nature (e.g. through a car or plane window). While each of these experiences are important modes for facilitating nature-connection, Freeman and Tranter suggest that 'direct' contact is the most effective for creating a strong and nurturing relationship with nature (Freeman and Tranter's 2011:162–163<sup>[18]</sup>). Lastly, we adopt Chrisna du Plessis and Peter Brandon's (2015:56<sup>[19]</sup>) definition of regenerative sustainability. As the authors explain:

Sustainability is based on a value system which holds that both people and nature should be treated with respect and in a spirit of fellowship and mutuality, and actions should focus not only on the wellbeing of humans, but on the wellbeing of the entire social-ecological system. This means that humans have a duty of care that requires them to support the wellbeing and evolution of the social-ecological systems of which they are part, and take responsibility for the consequences of their actions (du Plessis and Brandon 2015:56<sup>[19]</sup>).

While conventional approaches to sustainability generally focus on mitigation of impact, 'regenerative sustainability' aims to simultaneously improve environmental and human wellbeing and refers to the way in which 'sustainability' is nurtured through human-nature relationships. This concept of sustainability is one that is strongly associated with nature-connection. For example, from a regenerative perspective, an individual who already has a strong connection to nature, is not only likely to identify themselves as part of nature, but to also show value and care for their environment by supporting conservation efforts or taking action to enhance the capacity of the global and local social-ecological systems (Du Plessis and Brandon 2015<sup>[19]</sup>).

We begin by discussing the key points of 'flow' and 'vegetable being', followed by a summary of the project, our research methods, outcomes, and analysis of the findings.



## The concept of flow

Flow is a concept developed by psychologist Mihaly Csikszentmihalyi (1990<sup>[1]</sup>) that describes an intrinsically motivated and highly enjoyable psychological state of engagement. It is “the state in which people are so involved in an activity that nothing else seems to matter” (Csikszentmihalyi 1990:4<sup>[1]</sup>). Flow can be activated by a variety of activities that “involve patterns of action which maximize immediate, intrinsic rewards to the participant” (Csikszentmihalyi 1975:21<sup>[1]</sup>). It is most often stimulated by engaging in an activity that is both inspiring and effortless, as well as challenging enough for one to maintain focus (Nakamura & Csikszentmihalyi 2002:89-90<sup>[1]</sup>).

Flow activities lend themselves well to artistic practices that are focused on using creativity to increase intellectual and bodily cognition, focus and wellbeing. As psychologist Frances Kaplan (2000:76<sup>[1]</sup>) explains, “when art making partakes of the characteristics of ‘flow,’ it provides the kind of optimal experience that produces feelings of psychological growth and makes life in general more worth living”. Striking the ‘right’ balance to activate flow, however, is crucial: the creative task needs to be stimulating enough to maintain interest

but not overwhelming as to cause anxiety to the participant. The “unfolding of flow experience is shaped by the person and environment” and often requires continuous goal and feedback loops (Nakamura & Csikszentmihalyi 2002:91<sup>[1]</sup>).

Flow activities merge cognition, motivation and emotion – attributes that can lead to participants feeling greater self-worth and higher levels of concentration, opening up receptors for taking in new knowledge on a cognitive and visceral level (Csikszentmihalyi 1990<sup>[1]</sup>). Key characteristics of flow include: increased concentration; a greater integration of action and awareness; loss of self-consciousness; improved sense of control; altered sense of time; and an appreciation for activities that are intrinsically rewarding (Nakamura & Csikszentmihalyi 2002:90<sup>[1]</sup>). Over time, these attributes can be extended through regular flow-inducing activities to help increase concentration, creativity, and wellbeing – improving quality of life and building emotional capital for the future (Seligman 2002<sup>[1]</sup>; Kaplan 2000<sup>[1]</sup>). Thus, short term flow activities can also lead to more lasting effects.

## Connection to nature through vegetal being

Humans have an innate affiliation with nature due to our long history of evolution within the natural environment (Wilson 1984<sup>[1]</sup>). Connection to nature is defined as the degree to which an individual includes nature as part of their identity and is also an important predictor of well-being and ecological behaviour (Schultz 2002<sup>[1]</sup>). It includes a deep sense of belonging to the natural world, feelings of peacefulness and harmony; a sense of timelessness; humility; respect and developing a sense of place (Bragg et al. 2013<sup>[1]</sup>). One way in which humans can connect with nature is through ‘vegetal’ or ‘botanical’ crafting activities with living plants. Marder and Irigaray (2016<sup>[1]</sup>) refer to these kinds of creative tasks as one that activates ‘vegetal being’, a mode of meaningful engagement with plants that reveres their presence as agentic beings. Essentially, ‘vegetal being’ involves an act of embracing “the constitutive vegetal otherness in ourselves” so that we can allow the functions and adaptability of plant life to resonate with our own human nature (Marder 2013:36<sup>[1]</sup>).

Vegetal being “implies a heightened receptivity and openness to the endless variety of nonverbal languages that surround us” (Marder and Irigaray 2016:162<sup>[1]</sup>). Vegetal relating activities “let our expressiveness resonate with that of the animals, plants, and even minerals or rock formations we encounter” – to “experience a similar bodily welcoming of existence, the same opening unto the world, as a plant” (Marder and Irigaray 2016:162, 163-4<sup>[1]</sup>). Marder (2013<sup>[1]</sup>) also refers to this way of being as ‘plant-thinking’ – one that is free from the classifications, measures, and structures imposed by current philosophies and ontologies of scientific study. Instead of seeing plants as separate and subordinate objects,

plant-thinking allows for a more “equalized register of being that affects our cognition and perception of plants that can inform the way we live in, and consciously perceive, the world around us” (Gibson 2015:1<sup>[1]</sup>).

Ideas of ‘plant-thinking’ and ‘vegetal being’ extend culture, language, and social relations. Here, more-than-human encounters are considered as primal forces that exist within “state before ‘sense certainty,’” or “the indeterminacy of existence before it lends itself to self-assured judgment and interpretations” (Marder & Irigaray 2016:179<sup>[1]</sup>). As Marder (2013:1<sup>[1]</sup>) puts it, ‘plant thinking’ is “thinking without the head” in which the human is “de-humanized and rendered plant-like, altered by its encounter with the vegetal world”. Thus, engaging with vegetal life allows for humans to ‘think like a plant’ through the bodily and haptic. This allows for a co-creative engagement that disbands the anthropocentric divide between humans and plants, where activities with plants are given new insights that include a re-evaluation of their significance.

Similar to accessing flow-states, immersing oneself in ‘vegetal being’ includes engaging with plants in a way that is intrinsically motivated and receptive to sensory information with and about the natural world, without judgement. It offers a counter viewpoint to a more learned, scientific and cognitive understanding of plants which can be useful in engaging people of all ages and walks of life. We are interested in how these ‘vegetal’ (sensory) and ‘scientific’ (cognitive) ways of knowing can be linked together to help facilitate a connection with, and an understanding for nature.



## Introduction to Refugium



Figure 1: Refugium, Federation Square, Melbourne, 2016. Photo by Nick Roux.

Using vegetal-relating activities to facilitate nature connection was the impetus behind the first Refugium<sup>1</sup> arts-science project, created by Beer at Federation Square in Melbourne in 2016. Responding to the City of Melbourne's Draft Urban Ecology and Biodiversity Strategy, the project explored biodiversity in the city through participatory art-making with native plants. The work employed the community in creating kokedamas<sup>2</sup> (a Japanese art-form using moss and string to create a living sculptural piece) that were temporally installed in the centre of Federation Square for The Light in Winter Festival (June 2016) – creating a 'bush refuge'

in the heart of the city (Figure 1). The aim of the project was to use vegetal-crafting to foster a collective re-imagination of Melbourne as an interconnected, regenerative, and resilient system<sup>3</sup>.

It was during Melbourne's Refugium that Beer first noticed how flow was activated through the kokedama making vegetal-crafting activity – one that required increased focus but was not overwhelming, and provided immediate positive feedback through the emergence of a beautiful artefact. This observation was reinforced by responses from the participants who emphasised the 'relaxing', 'peaceful', 'meditative'

<sup>1</sup> A 'refugium' is a scientific term that describes an area where environmental conditions (abundance of resources and suitable micro-climates) have enabled a species or a community of species to take refuge during unfavourable circumstances (such as adverse climates, fire or disease). This area, acting as a 'refuge' allows the species to recover, thus making the ecosystem more resilient to environmental changes. As an artist, Beer was motivated by the idea of creating a 'bush refuge' that celebrated ecological diversity and resilience as well as providing a sanctuary from inner city life.

<sup>2</sup> Beer chose a simplified version of the Japanese technique, which was inspired by her personal and professional connections with Japan and Japanese culture. Kokedama is a unique waste-free art-form which uses moss (or coconut husks) and bio-degradable string to substitute the need for a pot. The merging of Japanese culture and native plants also plays homage to Australia's layered history of Indigenous culture and multiculturalism – a focus of The Light in Winter festivities

<sup>3</sup> A short 3 minute film of the project is available via <https://www.youtube.com/watch?v=QyDY4kKRX5U>





and 'grounding' qualities of the workshop<sup>4</sup>. Another feature that Beer noted was the eagerness of the participants to learn more about the scientific qualities of the native plants. These observations prompted Beer to seek out further possibilities to test the work, including examining how cognitive and sensory knowledge could be brought together to precipitate biodiversity understanding through flow-activities.

Less than a year later, an opportunity arose to take the Refugium concept to Perth (Western Australia/WA) as part of 2017 Propel Youth

Arts KickstART Festival. As a result, Refugium WA was designed specifically for Perth with a focus on celebrating its heritage as a biodiverse wetland. Hernandez was invited to co-lead the public workshops and impart valuable ecological knowledge to the participants during the plant-crafting activity. Together, our goal was to use the second iteration of Refugium to explore how Perth's unique climate could be communicated to the public through vegetal flow activities, thereby enhancing people's understanding of socio-ecological systems.

## Perth as a biodiverse wetland system

The aim of Refugium WA was to draw attention to the importance of Perth's unique biodiversity history, including its wide variety of plants and animals. Biodiversity is intrinsic to the sustainability, health and wellbeing of our planet but also to our survival as humans (Babu et al. 2005<sup>[9]</sup>; Sandifer et al. 2015<sup>[10]</sup>). Perth is the capital of Western Australia and the fourth most populated city of Australia. The city was founded in 1829 with settlement initially limited by temporal wetlands to the north east of the area. However, by 1838, Perth had grown across five wetlands, a trend which has continued to expand the city over more than 6,000 km (Figure 2). It is estimated that Perth's urban expansion has resulted in 72% of the wetlands of the area being lost or in extreme degradation since settlement (Parks & Wildlife 2014<sup>[11]</sup>). One of the factors driving the continued decimation of wetlands may be the historic lack of appreciation for them. The conviction that these 'unsanitary' and 'miasmatic' wetlands should be converted to more useful purposes is one that has largely prevailed Perth's trajectory since settlement (Black in Ryan et al. 2015<sup>[12]</sup>). As the region experiences seasonal inundation, many areas still suffer from re-emergence of water, often in areas where it acts as a hindrance for local businesses.

Nonetheless, Perth is recognised as one of the 15 biodiversity hotspots of Australia (Department of Environment and Energy) and is also one of the 25 global biodiversity hotspots (Myers 2002<sup>[13]</sup>). Perth's wetlands support a large diversity of aquatic flora and fauna, housing frogs, migratory birds and providing reliable sources of water for the wildlife, making it a priority area for conservation. According to Stenhouse (2004), in 1995, Dixon et al. estimated that there are 3,780 reserves scattered within Perth's metropolitan area and yet, because these reserves are generally small in size (~5oha) and highly fragmented (Stenhouse 2004<sup>[14]</sup>), their presence can easily go unnoticed within the city. Thus, our impetus for Refugium WA was to use arts-science knowledge to bring attention to Perth's wetland systems as unique and beautiful biodiversity hotspots within the urban landscape.

To facilitate the plant-crafting activities, we chose five wetland plants (sedges) that were native to Perth. These included: *Carex fascicularis* (Tassel sedge), *Isolepis cernua* (Salt Marsh Bulrush),

*Jun-cuskraussii* (Sea Rush), *Meeboldina scariosa* and *Lepidosperma squamatum*. Our intention was to draw attention to the resilience of these wet-land species, including their ability to thrive in full sun exposure, tolerate high levels of salt, and withstand conditions of abundant rain-fall and drought as well as provide vital habitats for native fauna. These plant characteristics and others became the details for the scientific knowledge which was imparted to the participants throughout the 1.5 hour time-frame of the kokedama-making activities.



Figure 2: Perth's Wetlands: A) Australia's biodiversity hotspots. Blue areas represent the different hotspots with the red dot indicating Perth. Source Modified from Department of Environment, and Energy; B) Reconstruction of Perth's Wetlands by Ryan et al. 2015. The red line indicates explorer Fanny Balbuk's journey to the area; C) Pre-settlement wetlands are superimposed to show that they are now completely urbanised. Google Earth image of Perth in 2017.

<sup>4</sup> A paper on the original Refugium project, "Refugium at Federation Square: the politics of participatory ecological artwork in public-private space" (Condliffe, Beer and Badham) is available in the forthcoming GPS journal.



## Refugium WA research design



Figure 3: Participants completing the pre- and post-activity survey. Photo by Paul Sutherland.

The research design for Refugium WA was conducted as a pilot for testing ways in which nature-connection could be examined in participants using a mixed-methods approach. We were interested in how the act of vegetal-crafting could facilitate a hands-on connection with the more-than-human world. Referring to Freeman and Tranter's (2011<sup>[5]</sup>) categories of 'nature experience', our study involved engaging participants in both 'direct' (through the vegetal-crafting exercise itself) and 'indirect' encounters with nature (via the scientific information conveyed by the kokedama teachers) during the workshops.

The workshops were conducted at a fully enclosed lab setting at Scitech – a science education facility devoid of outdoor views; thus, providing a stable environment where any change in the participants' experiences could be attributed to the botanical crafting exercise. A total of three 1.5-hour workshops were conducted with 53 out of 58 participants agreeing to partake in the research<sup>5</sup>. Five kokedama teachers were trained in both creative and scientific aspects of botanical crafting, facilitating the experience for smaller groups of 4-6 people and thus, enabling a more personalised activity to occur.

Indication of flow, biodiversity understanding, and increased nature-connection were measured by gathering observations of the participants, including collecting results from the pre- and post-activity surveys (Figure 3) to assess any changes in attitudes as observed by the participant. Questions were extracted from a series of index surveys, including the Nature Connection Index (Cheng and Monroe 2010<sup>[6]</sup>), Nature Relatedness Scale (Nisbet 2009<sup>[7]</sup>), EPOCH Measure of Adolescent Well-being (Kern et al. 2016<sup>[8]</sup>), PERMA Profiler Measure for Wellbeing for Adults (Butler and Kern 2016<sup>[9]</sup>) and Inclusion of Nature in Self Scale (Schultz 2002<sup>[10]</sup>). The pre-survey of ~50 questions combined a five-point Likert scale (1= strongly disagree; 5= strongly

agree), a sliding scale (1-10), a mood spot-check ('how are you feeling right now?') and demographic information. The same post-activity survey also included open-ended questions to allow the participants to expand on their experiences and perception of native plants, as well as express future aspirations for engaging with nature. Table 1 summarises the measures applied for each variable.

### Data Analysis

Once all the data was collected, we used the index surveys to calculate scores for wellbeing (as evidence of flow) and nature connection before and after the crafting activity. We then used the qualitative data to categorise nature connection into one of four stages: 1) increased awareness of nature, 2) desire of increased nature in the city, 3) ability to visualise or contextualise opportunities to increase nature in the city, and 4) the expression of action statements. Lastly, we applied a narrative analysis to reflect, interpret, understand and make connections between participants' responses in pre- and post-surveys, the conversations experienced by the kokedama teacher's and the researcher's observations (Clandinin 2007<sup>[11]</sup>). The multi-level analysis allowed us to record key moments across the workshops whilst identifying re-occurring themes before and after the activities. Together with the surveys, our observations and conversations with the participants became the main vehicle for gathering data on the project experience. The scores were not analysed for their statistical significance, but rather, used as evidence to build the narrative discourse analysis.

Based on Beer's observations of the original Refugium project in Melbourne, we hypothesised that the plant crafting activity would trigger a flow state in the participants, as well as increased capacity for nature connection through enhanced vegetal experience ('direct' engagement with nature) and cognitive understanding

<sup>5</sup> The research included a standard ethics process, whereby adult participants (or parents of child participants) signed consent forms which included permission to be photographed and filmed. To protect the participants' anonymity, survey responses were de-identified and thus, the photos in this paper have also been randomly selected and do not represent specific people discussed in the data or case study.



TABLE 1

Variables	Flow	Nature Connection
<b>Indexes</b> (quantitative data)	<p>A total of ten Linkert-scale statements were borrowed from the EPOCH Measure of Adolescent Well-being (Kern et al. 2016). Wellbeing was measured through five dimensions, including:</p> <ol style="list-style-type: none"> <li>(1) optimism (“I believe things will work out”)</li> <li>(2) happiness (“I love life”; “I am cheerful”),</li> <li>(3) social connection (“When I have a problem, I have someone who will be there for me”)</li> <li>(4) engagement (“when I do an activity, I enjoy it so much that I lose track of time”)</li> <li>(5) perseverance, (“when I make a plan I stick to it”)</li> </ol> <p>Questions inspired by the PERMA Profiler Measure (Butler and Kern 2016) included three questions focused on strategies to deal with stress (“I seek out creative activities when I want to relax”).</p>	<p>A total of 20 Linkert-scale statements were borrowed from the Nature Connection Index (Cheng and Monroe 2010) and the Nature relatedness scale (Nisbet 2009). The statements measured four dimensions of connection to nature:</p> <ol style="list-style-type: none"> <li>(1) experience of nature (“When I feel sad, I like to go outside”)</li> <li>(2) empathy for creatures (“Taking care of animals is important to me”)</li> <li>(3) sense of responsibility (“People do not have the right to change the natural environment”; “My actions will make the natural world different”)</li> <li>(4) sense of oneness or relatedness (“Humans are part of the natural world”)</li> </ol> <p>Additionally, the participants’ sense of ‘oneness with nature’ was measured using the Inclusion of Nature in Self Scale (Schultz 2002), a diagram presenting five levels of increasing identification with nature (See Figure.7)</p>
<b>Open-ended questions</b> (qualitative data)	<p>Mood spot-check: asking the participants to reflect on their current feelings. 15 words were provided, ranging from ‘stressed’ and ‘sceptical’ to ‘happy’, ‘peaceful’, and ‘exited’.</p> <p>Open-ended questions include: “What are you thinking about?”, “Describe how you felt making the kokedama”</p>	<p>Connection to nature was assessed across 3 different categories:</p> <ol style="list-style-type: none"> <li>(1) Kokedama-nature perception (“How do you feel about your kokedama?”)</li> <li>(2) Understanding urban nature (“How has this activity made you think differently about nature in the city?”; “Has the activity encouraged you to seek out more opportunities to engage with nature?”)</li> <li>(3) Understanding native biodiversity (“What are your impressions of native plants?”)</li> </ol>
<b>Research observations</b>	<p>Observations and conversations with the participants were collected via debrief sessions with the kokedama teachers via audio and video recordings, journal notation and photographs. These observations became the main vehicle for analysing enhanced social connection and immersion in the crafting activity, as well as evidence of flow and biodiversity understandings through conversations with the participants about Perth’s wetlands.</p>	

Table 1. Summary of variable measures

(‘indirect’ encounters with nature) as proposed by Freeman and Tranter (2011<sup>6</sup>). Professional limitations restricted us from following up with participants after the activity and thus, we were unable to determine how a short-term project could have an impact over time, particularly in regards to a person’s environmental actions. Therefore, the focus of our research design was to simply assess if the vegetal crafting activity could lead to increased nature-connection and biodiversity understanding within the 1.5-hour timeframe, including if it triggered any future aspirations for the participants<sup>6</sup>.

While our study aimed to adopt a holistic approach to data collection and analysis, our research design was largely used as a pilot for testing new approaches across arts-science methods. Thus, it was subject to limitations and bias which may have impacted the outcomes of the study, particularly in regards to our recruitment strategy, data

treatment and resource limitations. For example, the self-selected participant recruitment strategy (conducted via youth festival promotion) attracted participants who already had a keen interest in botanical crafting, and thus, tended to have higher levels of nature connection than the general population. Another limitation was the lack of a ‘control group’ to rigorously assess the potential of arts-science plant-crafting activities in facilitating nature-connection and understanding of biodiversity. A study containing a comparison between our integrated arts-science activity and ‘scientific only’ presentations of Perth’s biodiversity or kokedama-making without scientific input would have provided a stronger indication of the relationship between the sensory experience of botanical crafting and the cognitive knowledge transfer. However, due to the pilot study nature of the project, only limited resources were allocated to the research which did not allow for a control group to occur at the time.

6 For example, we considered any ‘action statements’ as the ‘intention to take action’ and viewed this as a positive result.





## The vegetal-crafting activity



Figure 4: Participants immersing themselves in the vegetal crafting activity. Photos by Paul Sutherland.

The vegetal crafting activity began with the participants engaging in 'plant thinking' as sensory exploration. Closing their eyes, the kokedamas teachers took the group through a meditative process of 'vegetal exploration', "of immersing oneself in the experience of (and with) plants" (Marder and Irigaray 2016:164<sup>61</sup>) by touching and smelling the sedges provided (Figure 4). The workshop then continued with an intellectual discussion of Perth's ecological con-

text as the participants crafted a nest of moss and/or coconut husks around their plant. As the participants gently wrapped the string around their plant spheres, the kokedama teachers spoke of the importance of biodiversity in facilitating resilience in a crisis (e.g. a disease, a flood or drought) and the importance of forging a notion of sustainability built upon the reciprocity of more-than human relationships.



Figure 5. Final installation of Refugium WA. Photo by Paul Sutherland.

Our intention was to draw the participant's attention to the sedges they were holding, as living objects of great value that can offer a safety net in times of uncertainty. We also invited people to think about how they could take part in regenerative sustainability by increasing the urban ecology of their own gardens. In summary, there were three key messages that we hoped to convey to the participants through the process of 'crafting sustainability': 1) an increased appreciation for vegetal matter; 2) a greater awareness of the importance of native plants for Perth's resilience, including their aesthetic value; and 3) an improved understanding of the need to encourage the propagation of native plants for a resilient future.

By incorporating both cognitive and sensory knowledge into the botanical crafting activity, we sought to create an opportunity for participants to forge a hands-on 'direct' connection with their plant-sculptures while also learning about the scientific concepts that related to its importance. As the groups became absorbed in the activity, we observed how their postures became more relaxed and a sense of ease and satisfaction washed over people's faces – there was a general sense of the participants becoming more focused and engaged. In handing over their plant-sculptures for the exhibition, participants expressed an enormous sense of pride and achievement in their work. What was created out of the workshops was a diverse assortment of kokedamas in all sizes, shapes and wrapping techniques – a wonderful depiction of 'the many hands' that shape a community. A few days later, the kokedamas were installed at the First Edition Café at the State Library of Western Australia with an invitation for participants to collect their plant-sculptures at the end of the week (Figure 5).

## Results

Overall, 53 participants agreed to participate in the research project. This included: young adults between 18-25 years old (49.06%); participants aged 12-14 (13.21%); participants under 12 (9.43%); 15-17 years (9.43%); 26-35 years (7.55%); 36-45 years (5.66%); and 46-55 years (3.77%). Other demographic data highlighted that participants were mostly from English speaking backgrounds (84.91%), lived in metropolitan Perth (75.45%), and were female (66%).

Based on self-reported feelings (mood spot-check), it could be proposed that 96.5% of the participants engaged in flow. Many noted how the activity allowed them to be interiorly focused on the task at hand, while others found that the activity opened them up to conversations with the other participants around them, many of whom were strangers (Figure 6 a-b). Our data revealed that the wellbeing score was very high both before and after the activity (44 and 45 out of 55 points respectively). This shift was equivalent to 1.65 higher after the botanical crafting activity, and further evidencing the potential for crafting activities to improve wellbeing (Table 2). However, it is important to highlight that we did not assess the statistical significance of this shift as the results are only relevant to

the participants of this study, and therefore, cannot necessarily be extrapolated to other groups.

Similar results were found when calculating the nature connection score. Table 2 shows an increase in nature connection equivalent to 1.03 points based on the Nature Connection Index and 0.3 based on the Inclusion of Nature in Self Scale. Upon further comparison of before and after responses to the Inclusion of Nature in Self Scale it was revealed that a total of 30% of the participants experienced an increased connection to nature. The shift occurred mostly through participants experiencing 'one-degree' increase (i.e. shifting from C to D) with 4% showing a two-degree increase in their connection to nature (i.e. shifting from C to E). These shifts towards a higher sensation of oneness between the participant and nature resulted 30% of the participants identifying themselves as part of nature compared to 20% of the participants at the beginning of the activity (Figure 7). However, not everyone experienced an increased connection with nature. In fact, 66% showed no change at all, while 4% had a negative shift of one degree (i.e. from C to B). For some, we identified that this was because they already felt connected to nature.



Figure 6: Indication of Flow during the vegetal crafting activity: a) participant engaging in an introspective flow; b) Participants actively chatting and becoming more socially active.

TABLE 2

	Max Score	Baseline	After the activity	Shift
Wellbeing Score	55	44.11	45.76	+ 1.65
Nature Connection Score	105	85.65	86.69	+ 1.03
Inclusion of Nature in Self Scale	5	3.56	3.86	+ 0.3

Table 2: Shifts in wellbeing and nature connection pre-and post- the botanical crafting activity.



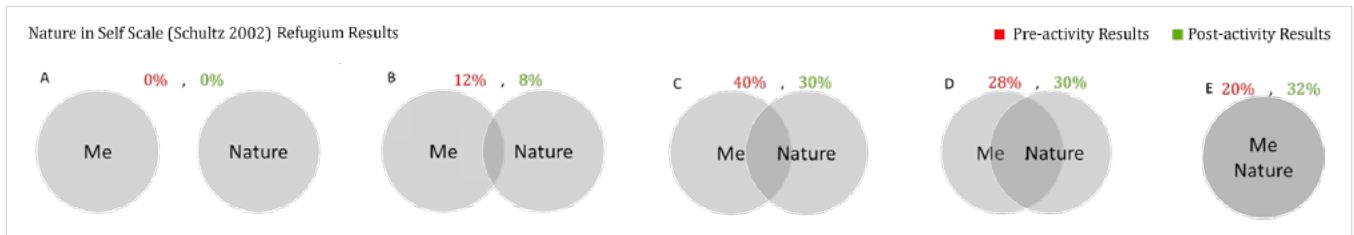


Figure 7. Nature in Self Scale (Schultz 2002)

Nevertheless, the short-time frame of the activity and restrictions in data collection made it difficult to assess the authenticity and depth of the 'nature-connection' experienced in the participants.

As highlighted above, the enclosed room of SciTech, allowed us to observe how the plants could serve as a medium for connection to ecology or 'nature' without the presence of the outside world. This meant that the value of 'spending time with nature' was reduced to the experience of the participants' engagement with the native plants. However, as the kokedama teachers were associating the

plant-crafting activity with broader ideas of ecology, it was hoped that the participants would connect their experiences with the wider world. While the concept of 'nature' was discussed as one that was about crafting ecological connection in the workshops, we acknowledge that the term 'nature' has many meanings and interpretations and thus, the participants' own understanding of nature cannot be differentiated as part of the analysis. This discovery was also observed through two case studies that we use below to illustrate how nature-connection was experienced subjectively amongst participants.

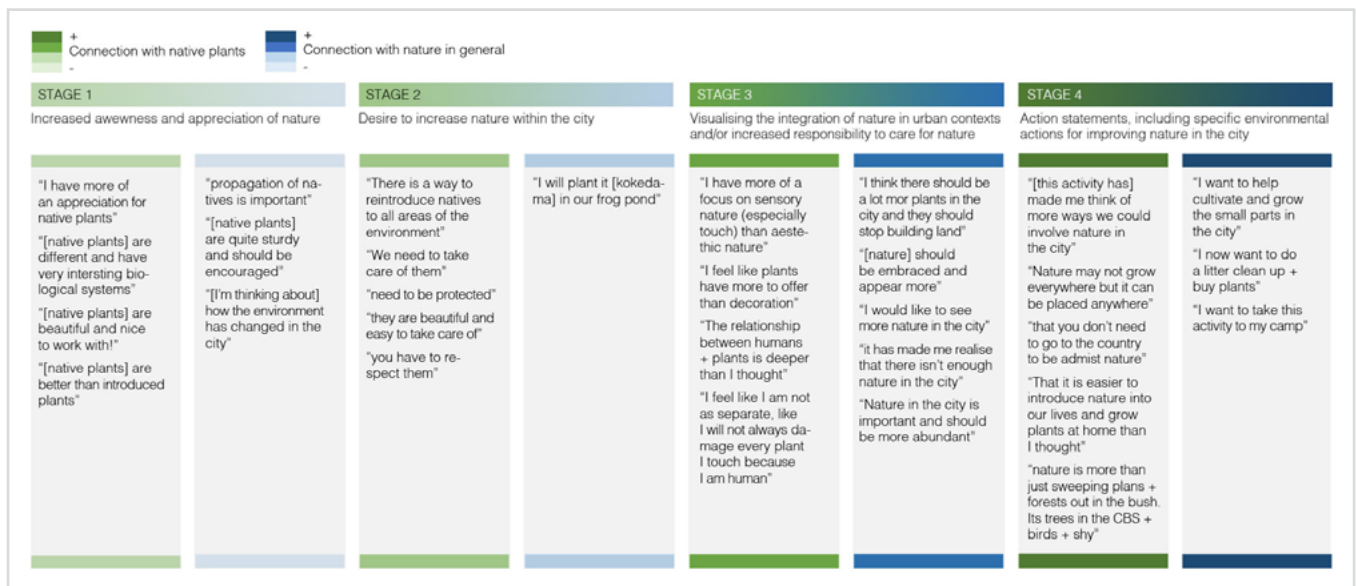


Figure 8. The trajectory of increased nature connection

## Case study one: Andrew\*

Andrew\* reluctantly attended the crafting activity, claiming that he had only agreed to participate on his friend insistence. Despite his hesitant start, Andrew soon became immersed in kokedama-making process, describing his state as "fully absorbed" in the pre-activity survey. The kokedama teacher observed how through the group's collective engagement, Andrew increasingly opened up to the activity and the social interactions that occurred around it. Through their conversations and appreciation of each other's crea-

tivity, there was a definite sense of the group focusing in on the activity collectively and experiencing flow together. Conversations opened up as discussions occurred around the artistic choice of coloured string and integration of cocohusks and moss, as well as the attributes of the plants themselves (Figure 9).

In his pre-activity survey, Andrew expressed a strong disagreement to the statement "I enjoy digging in the dirt with my hands", which

\* denotes name change to protect anonymity of participants. Andrew\* and Kate\* are not the participant's real names.



Figure 9. Community flow. Photo by Paul Sutherland. Disclaimer: photo chosen at random and does not necessarily portray the case study participant.

## Case study two: Kate\*

Similar to Andrew, Kate\* was invited to attend the workshop through her friend. Coming from another event, Kate arrived 15 minutes after the workshop had already started and therefore, indicated in her survey that she was feeling 'stressed' and 'anxious' at the beginning of the activity. Her pre-activity survey results also revealed that she was also feeling 'sceptical' about the workshop and thus, may not have expected to experience any changes in her mood. However, soon after she began the botanical-crafting activity, the kokedama teacher noted shifts in her temperament, with each stage of the workshop experience leading to her appearing more relaxed. As indication of flow, Kate reported feeling 'optimistic', 'confident' and 'amazed', 'reflective' and 'empowered' in the after-activity survey. Describing nature as a 'healing therapy', Kate stated that her biggest learning experience from the project was the importance of remembering how nature can make you feel more connected, mindful and present in the moment.

According to the Inclusion of Nature in Self Scale (Schultz 2002<sup>[9]</sup>), Kate's post-survey results demonstrated that she experienced one of the largest shifts in 'nature connection' in comparison to the other participants in the study. This scale demonstrated her moving from a close but separate identity between herself and nature to perceiving herself as part of nature (from C-E in the scale, see Figure 7). As one of only two people who included an action statement in their survey, Kate's transition was also revealed through her conversations with the kokedama teacher and her desire to replicate the plant-crafting activity at her upcoming youth camp as well as organise a litter clean up. Her keen interest to surround herself more with plants was also witnessed when Kate turned up at the State Library Café at the end of the week to pick up her kokedama (Figure 10). As she indicated in her survey, "I

he then shifted to 'strongly agree' at the end of the activity. While conversations with Andrew demonstrated that he already had a strong awareness of nature in the city, his post-survey revealed his increased appreciation for native plants, commenting that they are not only "beautiful and smell nice" but also that "nature can be very engaging and peaceful to work with". In one of his post-survey answers, Andrew wrote, "nature is more engaging and fun than I thought", potentially revealing how his initial reluctance to the plant-crafting workshop was overcome by the task at hand. At the end, Andrew circled the words 'empowered' and 'reflective' in the mood spot-check exercise of the survey. This reinforced our own observations of his transition through the workshop, as one of 'reluctance' or 'disengagement' to one of 'openness', 'enthusiasm' and 'commitment'. Overall, our results revealed that while Andrew already appeared to have a high level of connection to nature; there seemed to be a definite increase in his appreciation of native plants through the flow activity.

will pick it up because I would love to watch it grow and nurture it and look after it".

Overall, the case study may have revealed the clearest development in a participant within a short time-frame. For example, we could propose that from her initial state of disengagement, Kate engaged in flow which allowed her to experience mindfulness, this, in turn, enabled a stronger connection to nature – moving from stress, to flow, to the potential of eliciting ecological action and ripples beyond the project. Kate's action statements, supported by shifts in the survey, indicated that she was able to perceive her ability to positively impact the planet through the botanical crafting activity, which in turn, reignited her connection with nature.



Figure 10. Collecting kokedamas at the end of the exhibition. Photo Paul Sutherland. Disclaimer: photo chosen at random and does not necessarily portray the case study participant.

\* denotes name change to protect anonymity of participants. Andrew\* and Kate\* are not the participant's real names.



## Discussion

While the pilot research design presented limitations in our capacity to accurately generalise the outcomes of the project and its effects on the participants, there were some notable observations that are worth considering. Firstly, the biggest shifts were examined in participants who had attended our workshop unexpectedly or with little prior knowledge of what would be involved. This may suggest that flow activities may have the largest impact on those that do not anticipate its effects. Alternatively, creative tasks precipitating flow may also have the capacity to open up attitudes to subjects that are outside of one's current interests. As Kaplan posits, participating in creative activities "satisfies something deep within us" (1999:76<sup>[9]</sup>), opening up new receptors and experiences that can take us by surprise. For example, both Kate and Andrew indicated an initial reluctance to the plant-crafting activity which was overcome by becoming immersed in the task at hand. For Kate, experiencing flow through vegetal crafting may have been a way of letting go of personal stress and rekindling her connection with nature. For Andrew, experiencing the group's collective sense of flow could have allowed him to be more open and receptive to receiving scientific information.

According to their survey responses, Kate and Andrew appeared to reach different stages along the nature connection trajectory, particularly in regards to their perspectives of native plants. For example, while Andrew's survey results depicted that he had only progressed to stage one along the trajectory ('increased awareness and appreciation of nature'), his comments included an appreciation for native plants and their importance for biodiversity

## Conclusion

This paper has examined how activating flow through vegetal crafting can offer new strategies for arts-science communication that can connect people to the importance of biodiversity in urban spaces. As explored in Refugium WA, art-making with plants can provide an opportunity to engage in flow, opening up optimal experiences for taking in new knowledges that include the intellectual, kinaesthetic, olfactory and somatosensory. This can provide potential for positive social interactions, increased perceptions of human-nature relationships, better awareness of the value of plants, as well as a greater confidence in the ability to positively contribute to the life-enhancing capacities of local communities and environments for a regenerative future.

Nevertheless, we acknowledge that there are limitations to determining the effectiveness of short-term research projects of this kind and the transferability of the study, particularly in regards

– thereby fulfilling both categories. As stated above, the group's lively conversations during the flow activity may have made Andrew more open to taking in the scientific knowledge that was imparted during the activity. In Andrew's case, the act of 'making together' appeared to be integral to his experience of flow and perceived nature connection. This may also suggest that activating flow in one person can help precipitate flow in another.

By contrast, Kate was one of a handful of participants who reached all four stages of our proposed trajectory – including indication of her 'intention to take action' (stage 4). Csikszentmihalyi (1990:3<sup>[10]</sup>) explains how flow enables one to feel "in control of our actions, masters of our own fate". As flow merges cognition, motivation and emotion, we suggest that these experiences may lead to participants feeling greater self-worth and higher levels of concentration. For example, based on Kate's survey results, we could assume that her journey was more inwardly focused than Andrew's – one that was more engaged with 'vegetal being', which emphasised her own relationship with nature rather than scientific understanding<sup>7</sup>.

While both case studies demonstrated some evidence of how flow inducing vegetal activities can provide an opportunity to connect with nature, we also acknowledge that this experience can differ greatly amongst participants. The degree of nature-connection facilitated through the vegetal-crafting activity itself is also difficult to assess as it cannot easily be extrapolated from an individual's pre-existing understanding and experience of nature. This presents an important consideration for future research.

to how vegetal crafting can propagate long term impact. While this consideration is likely to influence the research design of the next iteration of Refugium, indication from the literature suggests that flow's positive and pleasurable characteristics may influence participants to engage in vegetal activities in the future (Chilton 2013:64<sup>[11]</sup>). As Nakamura & Csikszentmihalyi (2002:95-96<sup>[12]</sup>) contend, "experiencing flow encourages a person to persist at and return to an activity because of the experiential rewards it promises, and thereby fosters the growth of skills over time". This implies that there is potential for plant-relating activities (such as kokedama-making) to play a role in assisting communities to engage more with scientific concepts on a more personal level. For example, the inclusion of sensory knowledge through vegetal crafting could be a useful strategy for engaging children and people of mixed intellectual abilities in sustainability education.

<sup>7</sup> This is not to say that Kate did not register the scientific information. She may simply have chosen not to include it in her survey. However, this omission can also be interpreted as one that which is less important to her.



At the heart of Refugium WA was the investigation of alternative narratives for (re)connecting urban communities to ecological themes and practices. Sustainability issues are intrinsically social and any hope of changing people's hearts and minds requires breaking down cultural and social boundaries that reinforce nature-human dichotomies. Crafting together can allow groups to make meaningful and connections, form collective identities, which in turn may assist communities in tackling ecological and social issues more collaboratively (Beer 2017<sup>[1]</sup>). As writer Hannah Van Den Bergh contends, creativity's value is in its ability "to tap into a different instinct, rationale and emotion than political rhetoric, corporate sales-patter or even scientific data (2015:3<sup>[1]</sup>). We propose that vegetal crafting has the capacity to engage people of all walks of life in environmental projects – people who might not immediately

identify themselves as being devoted to sustainability, but through the act of being creative and engaging with flow may find themselves suddenly entwined in the process. Here, the notion of 'crafting sustainability' through kokedama-making is seen as one that actively fosters reciprocal connection of more-than-human relationships through the hands-on co-creation of a thriving future.

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# CRAFTING SUSTAINABILITY IN ICONIC SKYSCRAPERS

## *A System of Building Professions in Transition?*

by Kathryn B. Janda

*This paper focuses on coordination, fragmentation, and the potential for transition in the system of building professions in the American construction industry. The paper relies mainly on local press coverage of three iconic New York skyscrapers—the Empire State Building (completed in 1931), the U.N. Secretariat (completed in 1952) and One World Trade Center (completed in 2014)— to compare how the roles of different building professionals are seen by and portrayed to the public eye over time. The historic cases show how different professional groups—builders in the 1930s, architects in the 1950s, and engineers in the 2010s—imbued each project with “sustainable” qualities appropriate for its time. Using a system of professions (Abbott 1988<sup>[9]</sup>) approach, the paper describes and discusses the implications of changes in societal interest from doing to designing in American skyscrapers. The paper concludes by arguing that greater coordination between doers and designers in the construction industry, of the kind exhibited in the early days of skyscrapers, would enable the social production of sustainable buildings. For this to happen, however, society would need to place a higher value on tangible outcomes compared to lofty goals..*

**Keywords:** *builders, architects, engineers, skyscrapers, sustainability, professions*

**Author:** **Kathryn B. Janda**  
*Principal Research Associate in Organisations and Non-Domestic Buildings*  
Bartlett School of Environment Energy and Resources (BSEER), University College London, UK  
*Guest Professor, Department of Thematic Studies*  
Technology and Social Change (Tema T), Linköping University, SWEDEN

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## Introduction: Skyscrapers as socio-technical systems

Buildings consume almost half of the energy used in many developed economies and are considered to be one of the most important sectors for climate change mitigation (Edenhofer et al. 2014<sup>[9]</sup>). Owners and clients are often thought to be the main actors in building design decisions, capable of choosing whether and how to include sustainable elements in a building project. But what role do building professionals play in enabling/disabling the sustainability of the built environment? This paper contributes to a body of previous work exploring how individual professions and professional networks affect the uptake of energy innovations by focusing on: supply chains (Guy and Shove 2000<sup>[9]</sup>), property agents (Schiellerup and Gwilliam 2009<sup>[9]</sup>), builders (Killip 2013<sup>[9]</sup>, Janda and Killip 2013<sup>[9]</sup>, Janda, Killip, and Fawcett 2014<sup>[9]</sup>), building professions (Janda and Parag 2013<sup>[9]</sup>), heating installers (Banks 2001<sup>[9]</sup>, Wade, Murtagh, and Hitchings 2018<sup>[9]</sup>, Wade, Hitchings, and Shipworth 2016<sup>[9]</sup>), and architects and engineers (Janda 1999<sup>[9]</sup>, 1998a<sup>[9]</sup>, 1998b<sup>[9]</sup>),

This special issue of NJSTS considers the relationship between craft and sustainability. Other papers in this volume consider craft in the context of building homes and apartment buildings (Woods and Korsnes 2017<sup>[9]</sup>, Fyhn and Søråa 2017<sup>[9]</sup>). This paper extends the craft focus to building projects that are larger, more complicated, and more public: iconic skyscrapers in New York City. It centers around the relationship between builders, architects, and engineers, using a system of professions (Abbott 1988<sup>[9]</sup>) approach to discuss the implications of shifts in societal interest over time between *doing* and *designing* in the realm of American skyscrapers.

Today, skyscrapers are a common element of modern cityscapes, presenting recognizable patterns individually and as a group in the skylines of central business districts around the world. But in the not-so-distant past, they were quite an American innovation. Starting in the 1880s, the industrial age brought new materials to the construction industry—steel, concrete, and glass—and new building processes. It brought new services—electricity and telephones—which were followed by technologies like light bulbs and elevators that used these services to extend daytime and urban space. The technologies and economic rationales for skyscrapers and central business districts spawned new fields of study (particularly commercial real estate development). It also changed the relationship of existing professions. American engineers and builders were among the newly professionalized groups that arose to claim control of the new commercial and industrial building types, and architects were among the existing groups that had to adapt their more established practice to the changing times.

Although architects, engineers, and builders are distinct professional groups with specific areas of expertise, in the construction process they are interdependent. Buildings are shaped by the collective interactions of members of these groups, suggesting a construction system that is (or can be) tightly coordinated. Fyhn and Søråa (2017<sup>[9]</sup>) describe a highly harmonized form of work in their

study of high-tech Norwegian apartment construction practices. Typically, however, design and building processes are fragmented, both across professions and over the lifetime of the project. This suggests that the construction system also has ample room for discord and conflict. The World Business Council for Sustainable Development identified a series of functional gaps between (1) trades and professions that intersect with (2) management discontinuities in the building delivery process, resulting in what they called “operational islands” (WBCSD 2007<sup>[9]</sup>, p. 32, see Figure 1). Moreover, the professions themselves are constantly changing in response to larger social forces and trends, which creates additional opportunities for friction. Following from this logic, the construction industry is fragmented and perhaps even broken in ways that prohibit it from functioning as well as it could (Janda and Killip 2013<sup>[9]</sup>, Janda and Parag 2013<sup>[9]</sup>). Schiellerup and Gwilliam (2009<sup>[9]</sup>) call this the “social production of (un)sustainable buildings.”

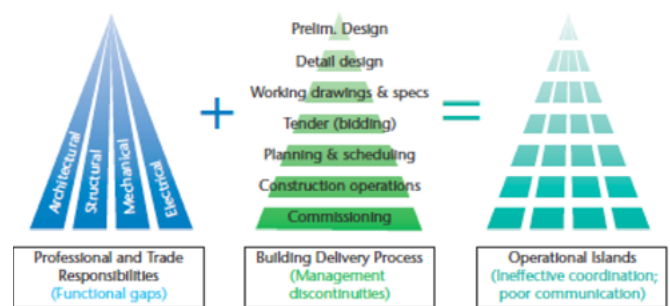


Figure 1. Players and Practices in the Building Market (Source: WBCSD 2007<sup>[9]</sup>, p. 32, Figure 3.12)

The extent to which design and making are separated or integrated is an embedded theme of this special issue, with papers on both sides discussing craft as various permutations of these practices. For example, in Beer (2017<sup>[9]</sup>) and Owen (2017<sup>[9]</sup>) the *designers* of urban ecology and knitting patterns are different than the *makers* and *doers*. In Hutchinson (2017<sup>[9]</sup>), the artist is both designer and maker. In Fyhn and Søråa (2017<sup>[9]</sup>), the *doers* create a new form of workmanship within the constraints of a highly automated and scheduled building design.

Reconsidering the relationship between designing and doing in the built environment raises a number of research questions. If gaps between building professions and management discontinuities are part of the “normal” construction landscape for buildings, when and where did this practice start, and how has it changed over time? Which building profession is in charge of the system of crafting buildings, and does it matter whether these professionals are architects, engineers, or builders? What qualities should a “good” or “successful” building have, and are some professions better at producing these qualities than others? A full social and historical examination of these questions is beyond the scope of this paper.



Instead, it offers a glimpse of this intellectual territory by examining public-facing reports in the media of three high-profile skyscrapers constructed at different points in time. The analysis shows that in the 1930s builders were revered as essential members of the building team; in the 1950s they were largely absent from news stories; and in the 2010s builders are present but not central actors. This finding leads towards an Orwellian observation about the construction industry: “all building professionals are equal, but some are more equal than others.”

What are the implications of professional (dis)integration, differences, and gaps for sustainability? Current definitions of sustainability often refer to a triumvirate of environmental, social, economic benefits. These are thought to be simultaneously obtainable objectives, for example in the business case for the “triple bottom line” (cf, Elkington 1997<sup>[9]</sup>). This frame for sustainability is, however, relatively recent. This paper considers sustainability in a broader historical context. A review of the term “sustainable” in the Oxford English Dictionary reveals that this term has been in use since 1611 and has carried three strands of meaning in 300 years: (1) capable of being endured; (2) capable of being upheld as true, and (3) capable of being maintained or continued at a certain rate or level (OED 2012<sup>[10]</sup>). The third strand of meaning dates back to a 1924 paper on population dynamics, and this strand evolved further in the 1970s to carry the environmentally-oriented meaning of “sustainability” explored in this special issue. As this paper considers two cases that predate the notion of *environmental* sustainability, it

uses the root definition of the term—“capable of being maintained or continued”—rather than the later meaning that connotes environmental objectives. This redefinition leads us to the question of *what* is being sustained by the production of these prestige skyscrapers and *by whom*?

The paper begins with a brief history of the relationship between urban development and professional practice in America, with a particular focus on skyscrapers. This section concludes with an introduction to Abbott’s “system of professions” theory, which is the main lens underpinning this paper’s comparative discussion of professions. Next, it moves on to the paper’s methodology, the selection of the cases, the reasons for using secondary methods, and the biases introduced. The paper then describes each in case in its historical context and discusses the professions involved as they were seen in the contemporary media of the time. A discussion section returns to Abbott’s assertion that successful professions are those that lay claim to solving particular socially accepted problems. Through the benefit of hindsight, it considers what qualities and social meanings the case study buildings have sustained, and which professions are most closely associated with these features. The paper concludes by arguing that greater coordination between *designers* and *doers* in the construction industry, of the kind exhibited in the early days of skyscrapers, would enable the social production of sustainable buildings. For this to happen, however, society would need to place a higher value on tangible outcomes in the built environment.

## Background: American urban development and professional practices

In late nineteenth century and early 20th century America, technological change and urbanization required new commercial and industrial building types. Many of these new buildings, including offices, apartment houses, hotels, and factories, sprouted without the benefit of architectural guidance. Unlike their European counterparts, American architects of this time had no clear role in society or long-standing tradition of practice. In response to the new building forms, many of which were “unpardonably bad” (Brock 1931<sup>[11]</sup>), American architects formed a variety of professional and educational institutions. The American Institute of Architects was founded in 1857; the Massachusetts Institute of Technology started an architecture department in 1866; and the first American architectural journal started in 1868 (Fitch 1973<sup>[12]</sup>). These institutions sought to extend the role of architects into the business community, beyond their more usual participation in public buildings, prestige dwellings, and churches.

American builders and engineers were closely and unambiguously linked to the new building technologies, methods, and forms—especially skyscrapers. The builders were masters of the new materials, physically responsible for erecting the structures and bringing the designs into being. The engineers controlled the machines: their jurisdiction included the mechanical, electrical, and

structural systems (in which they overlapped with builders and architects). Compared to architects, American engineers and builders were largely self-trained and lacking in academic ambition (Fitch 1973<sup>[12]</sup>). Professional societies for American engineers developed only a few decades after the American architectural institutions, but the disciplinary roots for engineers and builders were neither long nor fed by European history or traditions. European architects such as Le Corbusier and Adolf Loos saw the engineer as a kind of noble savage, a modern peasant who un-self-consciously created beauty by ignoring architecture and culture (Banham 1960<sup>[13]</sup>). Indeed, engineers were seen by both Americans and Europeans as creatures entirely without high culture.

Skyscrapers were an American response to the need for new building forms in the urban environment, and they posed new economic, aesthetic, functional, and social questions. Early proponents of skyscrapers believed firmly in the “fundamental importance” of economic criteria, and they justified the development of skyscrapers with detailed studies of their economic viability (Clark and Kingston 1930<sup>[14]</sup>, Morgan 1934<sup>[15]</sup>, Simon 1929<sup>[16]</sup>, Starrett 1928<sup>[17]</sup>). These writers were often engineers or builders, two professional groups with clear motives for perpetuating this building form. Opponents of skyscrapers claimed they created more



problems than they solved, turning streets into narrow canyons, inhibiting the passage of light and air, and increasing congestion. Such battles on functional and economic grounds all but eclipsed formal and stylistic issues about skyscrapers voiced by American architects. Some American architects recognized that the so-called new “American” style of setback skyscrapers was based on the same principle used by the Mont St. Michel in Brittany and the oldest pyramid in Egypt; accordingly, their formal qualities were neither new nor uniquely American (Sexton and Walker 1928<sup>[6]</sup>).

Despite quibbles over where the visual vocabulary originated or what it symbolized, through the first quarter of the twentieth century, skyscrapers were American by default if not by design. Europeans were interested in the concept of skyscrapers and perhaps even believed the economic arguments for their development, but cultural barriers prevented their construction in Europe (van Leeuwen 1988<sup>[6]</sup>). Artists Glyn Philpot and Henri Matisse praised the skyscrapers in New York, but said they would look “ridiculous” in their own countries (NYT 1930<sup>[6]</sup>).

In this paper, these conflicts between different professions with regard to a new American building form (skyscrapers) are viewed through the lens of Andrew Abbott’s 1988 theory regarding a “system of professions” (Abbott 1988<sup>[6]</sup>). This approach fits within the general sociology of professions (Tripier and Dubar 2005<sup>[6]</sup>). It is concerned with the ways in which different professional or occupational groups define their work and compete for authority, which is linked to their use and appropriation of knowledge. From a system of professions perspective, each work group is linked (neither permanently nor absolutely) to a set of socially-accepted tasks considered to be its “jurisdiction”. Professional groups compete

and develop interdependently, based in part upon their ability to perform (and defend) the tasks within their jurisdiction.

Gaining control over work is an important goal of most professional groups. In the building industry, as in medicine, the major groups involved in the process hold different degrees of power. Doctors, for instance, have more authority than nurses but neither group can treat patients without their consent. Similarly, architects, engineers, and clients enter into an interdependent yet structured negotiation with each new building design. Traditionally, architects control the overall design of a building, directly negotiating with the client, the subcontractors (including the engineers), and the builder during construction. Under subcontract to the architect, engineers design the structural, mechanical and electrical components of the building and may contract out their installation or install these components themselves.

According to Abbott’s theory of professions, differences between professions matter because they are neither haphazard nor objectively rational. In Abbott’s view, these differences serve a strategic function, enabling them to retain socially legitimate control over their separate jurisdictions. Yet jurisdictions and professions change over time and are shaped by a number of social, economic, historical, and institutional factors (Abbott 1988<sup>[6]</sup>, Bureau and Suquet 2009<sup>[6]</sup>, Evetts 2006<sup>[6]</sup>). This paper and previous ones (Janda, Killip, and Fawcett 2014<sup>[6]</sup>, Janda and Killip 2013<sup>[6]</sup>, Janda 1999<sup>[6]</sup>) are concerned with jurisdictional changes to building professions, mainly in regard to energy and environmental considerations. These issues will be further described in the concluding section, after a discussion of three building case studies.

## Methodology and methods

The three skyscrapers selected for this paper are chosen for their fame and iconic status at different points in time. Each case is a highly publicized prestige building that garnered much media attention during the time of its design and construction. In this sense, each case in this paper belongs to a larger set of socially important buildings that have attracted attention from architectural historians, urban planners, financiers, and the public.

Two of the cases—the Empire State Building and One World Trade Center—are important in part (but not exclusively) because of their height. Between 1930 and 2017, 126 supertall buildings have been built around the world (CTBUH 2017<sup>[6]</sup>). Standing at 1250 ft (381 m), the Empire State Building was the tallest building in the world from 1931 until 1973, when it was eclipsed by the original twin towers of the World Trade Center. The Empire State Building was built during the Great Depression following the 1929 Wall Street stock market crash. At the time, its construction represented a symbolic triumph over grim economic conditions.

Between 1931-1969, there was a worldwide hiatus in the construction of tall buildings. The U.N. Secretariat was built during this period. It is a prestige building but stands only 505 ft (154m) high. Its prestige derives not from its height, but from the importance of its mission: to house the headquarters of the newly-formed United Nations. Its role was to provide a symbol of peace and international cooperation after World War II.

From 1930-1990, supertalls were an exclusively American construction form and then only built in sparingly in Chicago and New York. In 1990, these goliaths started to appear much more frequently in Asia and the Middle East, as well as elsewhere in the USA. One World Trade Center, completed in 2014, is the tallest building in the western hemisphere, but not the tallest building in the world. Built on the site of the former Twin Towers destroyed in the September 11, 2001 terrorist attacks, it holds special significance as a reaction to that catastrophe.

As a historically-oriented paper, the analysis uses secondary sources and draws inferences based on articles written at the time each



building was designed and built. Articles were found by searching newspaper and publications databases for the name of the building and selecting articles contemporary to the relevant time period. The goal was to investigate what social meanings the buildings and their professions had *then*, not now. The discussion and synthesis sections slightly deviate from this approach, using the benefit of hindsight and history to describe how the Empire State Building and the U.N. Secretariat have evolved in practice. This provides a basis for considering transition pathways to a future system of building professions.

Since the cases are widely dispersed in time, there is an additional wildcard to the analysis. The sources of public information have changed in 90 years, both in type and in nature. The etiquette of print reporting changed from the 1930s to the 1950s to the 2010s. Although the kind of information and perspective included in “a newspaper story” has changed over time, controlling for this shift is beyond the scope of this paper. All three case studies rely largely on newspaper stories as the dominant form of searchable media, with one exception. Following the advent of the internet in the 1990s, the One World Trade Center (One WTC) case study also includes videos and websites. These online sources are included because they take thought, time, and effort to construct. A review of social media

is excluded due to the more ephemeral and reactive nature of this form of communication. The contemporary sources were found in a contemporary way: by Google searches for the building name and companies involved in its construction.

A different selection of cases (for example, a focus on recent sustainable skyscrapers (cf., Inhabitat 2017<sup>[1]</sup>) would no doubt shine a light on different facets of the relationship between construction professions and sustainability. The research design is therefore consciously exploratory rather than explanatory. It looks for sustainability in places where it may or may not be found. There is no control group, and no attempt to normalize the results. And yet, in relation to the question of what is sustained over time, each of these cases provides a built response to social desires at the time of its inception. Further research with additional cases would yield additional insights, but they would also lengthen the analysis considerably. Although other research designs might hold more explanatory power, each of the selected cases illuminates an important historical facet of the ongoing professional relationship between builders, architects, and engineers from the perspective of what is newsworthy (through the lens of public media) or interesting (through the lens of professional and academic publications).

## Three cases of building professions and New York skyscrapers

Each case description opens with a short historical narrative about the role of building technologies and professional responsibilities at the time of construction. Following this narrative, the roles of

architects, engineers, and builders are articulated, compared, and synthesized in context with the perceived and socially constructed “success” of the building.

### Case 1: the Empire State Building (1931)

As skyscrapers evolved and proliferated into the twentieth century, American architects found themselves in conflict not only with the concept of technology but with the social groups, value structures, and practices which supported these new building forms. The values embedded in mass production were contradictory to the traditional practice of architecture as special and extraordinary. Subjective, aesthetic ideals threatened to be subsumed by rational engineering principles; questions of social values were being replaced by summations of economic benefits. The new social emphasis on economics and technology supported ideals of efficiency more easily than it did the pursuit of aesthetic quality, and architectural organizations found themselves fighting to protect their profession.

By the 1930s, many American architects viewed the rise of engineers and builders with trepidation, seeing a potentially destructive conflict between their craft and these other professions. The American Institute of Architects (AIA) reported that competition with construction firms “might result in a complete submergence of the professional ideal at the cost of esthetic values.” As “foes

of ugliness,” the AIA developed a broad manifesto aimed at preserving the architect’s position in American society (NYT 1930a<sup>[1]</sup>). On Christmas Day 1932, *The New York Times* published a long article detailing L. Andrew Reinhard’s vision of a new era for architects (NYT 1932<sup>[1]</sup>). This article recognized that recent developments in the building industry would change the role of architects. Whereas the old way of building valued appearance, cost, and time (in that order), the new era valued cost, time, and appearance. As a result:

*Making fine presentations and attractive drawings no longer is of first importance, and architecture no longer is a one-man job. The architect of the future in large urban jobs will much more frequently find himself a member of a group or groups representing the economic, functional, and esthetic factors governing modern building. Each of these groups, from a different angle, will be working for a solution of related problems out of which the coordinated project will emerge.*

In response to the economic conditions of the time, American architects took a practical approach to their changing status.

<sup>1</sup> Reinhard was a prominent New York architect of the time and was the general architect for Rockefeller Center, built in 1929.





Raymond Hood, speaking on behalf of the Architectural League of New York, said that architecture had “become a combination of the arts and sciences and not merely an expression of art” (NYT 1930b<sup>[9]</sup>). While Hood may have believed that architecture needed to fit itself into the new order where cost is paramount, the actual process of combining art and science seemed problematic. He foresaw coordinated efforts between architects, sculptors, muralists, landscapists, and craftsmen, but did not include builders or engineers in this matrix of cooperation.

While American architects of the early 1930s worried about the demise of aesthetic criteria in the face of economic concerns, engineers were calling for coordinated efforts between groups involved in the building process. Their immediate goal was greater efficiency of construction, but their interest extended beyond the technical specifications of building systems. Articles such as Mortimer Freund’s “Heating and Air Conditioning Must Be Carefully Considered in Design of Buildings” (Freund 1931<sup>[9]</sup>) appeared steadily in engineering journals of the time. Such articles argued that close cooperation of architects and engineers would result in “a better building, a satisfied owner, and an important reduction in cost.” Beyond the function of the building itself, there was significant published concern about the future effects of skyscrapers on public utilities, transportation, and economic viability of neighborhoods (Simon 1929<sup>[9]</sup>). Not all engineers were broad thinkers, however, for there were certainly those who believed “it is a fair statement to make that the building is no better than its mechanical equipment” (Ralston 1930<sup>[9]</sup>).

Builders shared the engineers’ emphasis on the importance of time and money over aesthetic criteria. A building was “successful” if it was quickly and efficiently constructed. In a 1928 book entitled “Skyscrapers and the Men Who Build Them”, W.A. Starrett—one of the brothers whose company built the Empire State Building—urged cooperation between groups involved in the construction process, specifically between architects, owners, and builders (Starrett 1928<sup>[9]</sup>). While engineers seemed to see their role as equal and integral to that of the other groups, Starrett positioned his profession as the star of the show: both different and better. In the eye of the builder, architects and engineers had more in common with each other than the builders had with either group. While architects and engineers only design and draw plans, builders “devise ways and means of accomplishing the completed whole” (Starrett 1928<sup>[9]</sup>). To the proudly practical builders, the process of realizing physical achievements was more important, more dramatic, and more meaningful than aesthetic, theoretical or intellectual advances.

The entire Empire State Building was constructed over the course of 11 months (1930–31), during a time of social flux and economic crisis. Two months after Alfred E. Smith announced his plan to build the highest building in the world, the stock market crashed. The project went ahead, financed by loans, but clearly it was part of the “new” architectural era where priority was placed first on

cost, then on time, and finally on appearance. The ordering of these priorities affected the design and construction process of the building and accordingly influenced its final form.

A May 2, 1931 *New York Times* article announces the opening of the Empire State Building by the United States President Herbert Hoover (NYT 1931<sup>[9]</sup>). This article focuses on two attributes: the height of the building and the coordinated effort of the groups involved in its construction. A stunning 18 inch (46 cm) high photograph of the building dominates a full page story, supporting the caption “the highest structure raised by the hand of man.” Portraits of “the four men who created the Empire State Building” appear beneath this impressive image. Depicted here are William Lamb, the Architect; H.G. Balcom, the Engineer; Col. W. A. Starrett, the Builder; and Alfred E. Smith, President of the Owning Company.

### Architects (Shreve, Lamb and Harmon)

Although the American architectural community gave Shreve, Lamb, and Harmon an award for the Empire State Building, the design’s aesthetic reception was lukewarm at best. A 1931 editorial in *Architectural Review* focused on the building’s height (“Nearly three times as high as St. Paul’s”) and practical design rather than its style (Editorial 1931<sup>[9]</sup>). This article suggests that Lamb made every effort to eradicate frivolous ornamentation and create an efficient design. His window details provided a simple juncture between wall and window to abolish “inadequate and useless” reveals and enable efficient construction. Lamb designed the building from the inside out, arranging the available floor space for optimum efficiency at the various setback levels required by the city.

Although William Lamb’s approach to designing the Empire State Building makes him an exemplary “modern” architect as described by Reinhard, it does not make him an aesthetic visionary. In a paper published in *The Architectural Forum*, Lamb insists that “whatever ‘style’ it may be is the result of a logical and simple answer to the problems set by the economic and technical demands of this unprecedented program” (Lamb 1931<sup>[9]</sup>). Instead of maximizing the design opportunities, he explicitly sidesteps them. It is as though the building’s form developed almost autonomously from its intended function, without the help of his or any other human hands. He extends this “automatic” motif to the construction process by comparing it to that of an automobile on an assembly line. The builders, however, describe it quite differently.

### The Builders (Starrett Brothers)

Of the professional groups participating in the Empire State Building, the builders make the greatest bid for heroism. They favorably compare “their” achievement to the height of the pyramid at Gizeh (sic.) and the time it took to build St. Peter’s in Rome (Morgan 1934<sup>[9]</sup>). While the structure itself is impressive, builders depict the construction process as more important than its product. Starrett (1928<sup>[9]</sup>) describes building as a kind of sporting event, where builders perform in front of an imaginary “enthusiastic spectator who gazes with admiration at some feat of skill and



daring...and perhaps sees nature used against its very self in the accomplishment of a spectacular bit of work." Compared to Lamb's seemingly autonomous design development, men are central to the builder's perspective. A pictorial record of the Empire State Building's construction contains drawings of men (sometimes with their shirts off) in confident control of great steel columns (Rudge 1931<sup>[6]</sup>). These builders and "daring craftsmen" are "big, husky Swedes" and other immigrants (if American, they are said to be half-breed Indians or Southerners) who courageously walk narrow beams with "easy nonchalance." The risks these builders took were real: fourteen deaths occurred during construction of the Empire State Building. The fact that these deaths are not mentioned in the laudatory literature or in *The New York Times* articles suggests that cultivating a heroic image was more important to builders and readers of the time than accurately reporting safety accidents and failures.

For a time when most Americans were out of work, the making of the Empire State Building was an important achievement. Thousands of craftsmen from 32 different fields completed the building in record time. The lead craftsman from each field was given a certificate of recognition for his achievements, and their names are contained on plaque in the main lobby (Empire State Realty 2017a<sup>[6]</sup>).

### The Engineers (H.G. Balcom)

Compared to the architect and the builders, the engineers have little to say about the importance of their role in constructing the Empire State Building. Balcom does not write up the details of his experience for review in the major engineering journals. A few articles describe the details of the mechanical systems (Mayer 1930<sup>[6]</sup>), the electrical systems (Walsh 1931<sup>[6]</sup>), and the structural design, (Edwards 1930<sup>[6]</sup>) but the self-praise in these articles is noticeably slight. Technologically speaking, the Empire State Building pushed few boundaries other than its height. It depended on steam and electricity from public utilities so there were no generators on site. Air-conditioning had recently been used in the Milam Building of 1928, but this new technology was not installed in the Empire State Building more than 30 years after it opened. Steel and glass curtain-walls appeared in other buildings of the 1930s,

but the predominant Empire State material was routine limestone cladding. Without cause to describe anything really revolutionary in their field, the structural, electrical, and mechanical engineers could not and did not vie for public acclaim for their contribution to the project.

### Synthesis

The Empire State had nine more rentable floors than the Chrysler Building, the cathedral of capitalism, but none of the ornament. Its original design height was 1050 feet, only 4 feet higher than the top of the Chrysler Building's spire. It was at the suggestion of John Raskob, the developer, that the Empire State further distinguish itself as the tallest building in the world by adding a 200 foot dirigible mooring mast to the top. This idea of integrating future transportation options in the building design was somewhat akin to Le Corbusier's Contemporary City design of 1922, but it is significant that this vision did not come from an architect. It was proposed by a member of the only group that could impose extra costs on the project—a developer.

The Empire State Building was more a triumph of construction process than a prosperous commercial building. Despite all of the coordinated energy its architects, builders, and engineers devoted to its efficient design and construction, once built the building was not as financially successful as its owners had hoped. It was hard to rent and remained half empty for much of its first two decades. The building also experienced other unexpected problems: it acted as a lightning rod, and it served as the setting for at least sixteen suicides. The planned dirigible mooring mast never brought air traffic to the heart of Manhattan, but it worked as an architectural element when revamped as a hollow tower. It also served as a focal point for the fictitious battle of King Kong against the biplanes. The Empire State Building successfully achieved fame if not fortune. It was the tallest building in the world for more than forty years (1931-1973). One commentator summed up its achievement as:

*The Empire State Building, bigger, grander, more amazing than any other building ever built, rising out of and above the Great Depression, was a significant boost to the morale of the city. It was a statement: despite all the problems, we can do this. (Levy 2015<sup>[6]</sup>).*

## Case 2: The UN Secretariat (1952)

Technological enthusiasm was a rising tide in America until the 1930s, but it was checked by the depression and altered by World War II. During the 1930s and 1940s construction slowed, and in the interim simplicity, economy, and efficiency became formal as well as functional criteria (Fitch 1973<sup>[6]</sup>). American architects such as Albert Kahn, Raymond Hood, Norman Bel Geddes, and Walter Teague began to rely on visual clarity for effect not just for economic viability. A new conception of architecture developed that emphasized volume rather than mass, combining elements of the setback skyscraper and the International Style. In commercial

architecture, this was often (although not always) expressed in rectangular steel-framed boxes. European architects working in the United States—Le Corbusier, Walter Gropius, and Mies van der Rohe—pushed the trend to its fullest extent.

In establishing themselves as the expressionists of modernity, architects successfully resurrected the use of aesthetic criteria in American commercial construction. Concurrently, they appropriated concepts from the engineering mentality and relegated engineers and builders to a subordinate position in the construction process. As the machine



aesthetic became more widely known, the machines themselves became less visible. Building equipment functioned supportively, behind screens and in basements. Clients wanted the advantages of new building technologies, but they were not interested in the incremental process of their development. Air-conditioning was an expected service; how it was provided was of little concern unless there was something fundamentally different about the system.

Whereas the Empire State Building provides an example of coordinated and economically efficient design and construction, the process of designing, planning, and building the United Nations Secretariat complex in New York was fraught with difficulty and delays. *The New York Times* was able to select and print the pictures of the four men responsible for the Empire State Building, but no such clarity of participation was possible with the United Nations headquarters. For a building that was supposed to symbolize world peace and international collaboration, the design and building of the U.N. Secretariat was a process fraught with conflict.

#### **Architects (Le Corbusier, Niemeyer => W.K. Harrison)**

The U.N. Secretariat was a conscious experiment in consensus architecture. In 1947, the acting Secretary General asked 54 member nations to submit the names of outstanding architects from their countries to sit on the design panel (NYT 1947a<sup>[1]</sup>). The list was shortened to the ten best, then cut to five, which included France's Le Corbusier and Brazil's Oscar Niemeyer. The U.S. was not allowed to submit an architect, but Wallace K. Harrison was appointed director of planning, a role that effectively functioned as chief architect, and three American architectural firms (Skidmore, Owings & Merrill; Clarke, Rapuano & Holleran; and Voorheese, Walker, Foley & Smith) were selected as associate architects (NYT 1947b<sup>[1]</sup>).

According to a *New York Times* magazine article entitled "What Kind of Capitol for the U.N.?" (Samuels 1947<sup>[1]</sup>), the rhetoric espoused by the international architects on the design panel was to produce a building that grew out of the practical functions that needed to be performed within it. The further desire was to include provisions for cutting-edge technological systems such as television monitors, push-button weather controls, and pneumatic message tubes. Although the interest for these internal functions may have been shared by most of the architects trying to work in tandem on this project, the external statement was greatly debated. Le Corbusier felt the complex should not symbolize "a world capitol, or a temple of peace" because the U.N. did not yet exist: the nations were not united. Instead, he saw a meeting place which was to be a model of efficiency which provided perfect working conditions. Other architects in the group felt the design should be not only international, but un-national; that it should reflect the "true spirit of our age" or that it should show "stability and wide purpose," something that went beyond a rectilinear box clad predominantly in glass.

A review of architectural literature does not make clear who was responsible for what part of the Secretariat's final design. Harrison

was sometimes identified as chief architect, sometimes called "chief planning officer" (Barrett 1948<sup>[1]</sup>), or "planning director" (NYT 1948b<sup>[1]</sup>). Also involved in the process were Deputy Planning Director Max Abramovitz and Glenn Bennett, the executive officer of the planning division. Le Corbusier is generally credited with the original idea and design for the 39-story secretariat, but he was not allowed to participate in the building process or review changes to his plans (NYT 1948a<sup>[1]</sup>). The Fondation Le Corbusier includes his sketches of the complex in their anthology of his work (Le Corbusier 1983<sup>[1]</sup>), and Le Corbusier compiled his own ideas about the project in a book (Le Corbusier 1947<sup>[1]</sup>). The lower, curved Assembly building is generally credited to Oscar Niemeyer. However, the University of California, Berkeley architectural librarians file images of the Secretariat under "Harrison and Abramovitz", which points to the formal record of their inputs. After the Secretariat's completion, Harrison receives the most administrative credit for the project. He was called the "unwilling hero" and a "new kind of architect" for presiding over three years of conflict between initial design and completion.

#### **Builders (various)**

Like its design process, the construction of the U.N. complex was fragmented and distributed amongst several players. The building apparently did have a "coordinator of construction" named James Dawson (NYT 1948b<sup>[1]</sup>), but his role in the project is unclear. Pieces of the project were given to the lowest bidder, not to the best, brightest, or most powerful. Although the contracts awarded were dutifully reported, there was no coherent story developed from the building process as there had been for the Empire State building.

Even if one construction firm had carried the task through from excavation to exterior finish, however, the time had passed for glorification of this process. In the 1930s, builders were proud of the system they devised to construct skyscrapers. Two decades later, however, the concepts involved in building a steel framed skyscraper were no longer new. The construction system was still running, and the builders who ran it were unimportant. After building 85 stories of steel and limestone, 39 stories of steel and glass was not a topic of conversation in the press.

#### **Engineers (various & anonymous)**

Although the glazed Secretariat would probably been unbearable to work in without air-conditioning, the research found no laudatory articles in engineering journals detailing the achievements of the cooling system or its designers. The building uses the Conduit Weathermaster system, which was developed by Willis Carrier and first implemented in the Philadelphia Savings Fund building of 1932. An article in *The New York Times* on the environmental controls in the Secretariat, however, quotes a representative from the Johnson Service Company rather than from Carrier. It is unclear to what extent the system in the Secretariat represented a departure from other air-conditioning systems in use at the time. On the one hand, the system was a "crowning achievement" because of its magnitude and ability to handle unprecedented loads (Banham 1969<sup>[1]</sup>), and it was interesting to the public because of



its 4,000 decentralized temperature controls (Teltsch 1949<sup>[6]</sup>). A seven-page article about the Secretariat in *Architectural Forum* suggested that the service of conditioned air was not new, and its application in the Secretariat represented “nothing revolutionary” (Ellis 1950<sup>[6]</sup>). Only the lighting engineer was mentioned by name because he designed completely new fixtures for the lobby (Ellis 1950<sup>[6]</sup>).

### Synthesis

In the U.N. Secretariat, compared to the Empire State Building, architects took (or were ceded) greater levels of aesthetic control. They successfully managed other professions to achieve their desired aesthetic effect. Their role was neither a “one man job” of previous buildings, nor even the joint effort portrayed in the 1930s; Harrison acted instead as the primary decisionmaker above and beyond the engineers and builders. With architects as primary decisionmakers, aesthetic considerations once again took some precedence over economic efficiency. Harrison turned the building away from its most energy-efficient orientation on the site because of the view from Manhattan. Light-colored venetian blinds that would reflect more sun heat out of the building and

lighten the cooling load were rejected because they would make “an irregular pattern” when seen from the street (Ellis 1950<sup>[6]</sup>).

Le Corbusier had hoped the Secretariat’s form would become an image synonymous with world peace. Although this design goal was not fully met, it is certainly an iconic building. Although its form was influential, the Secretariat did not, in fact, function as the “perfect” work environment. When workers moved into the building, they found that the external promise of the structure did not translate well to the interior (Barrett 1950<sup>[6]</sup>). Although the solid glass facade led workers to think they would have more access to views, perimeter space was given to ranking officials, not to all workers. The exciting “mechanized city” replete with internal televisions and electronic communication systems were inhabited by some who still preferred to use file folders. The heat-absorbing windows protected workers from some of the sun’s intensity, but the blue tint meant their eyes had to adjust when they opened the windows. The vertical distribution of space was also mentioned as a hindrance; workers preferred horizontal hallways where they ran into colleagues more frequently.

## Case 3: One World Trade Center (2014)

By the mid- to late-twentieth century, vertical distribution of space in urban settings became commonplace. Starting in 1969, the world saw hundreds of skyscrapers and dozens of supertall buildings, built all over the world. This includes the 110-story Twin Towers at the World Trade Center, which were originally completed in 1973. They were demolished by two planes in terrorist attacks on September 11, 2001. These attacks ushered in a new era of concern about skyscrapers, symbolism, and safety (Glanz 2014<sup>[6]</sup>). The original name for the winning project to rebuild on the site of the Twin Towers in 2003 was “Freedom Tower.” It was officially changed in 2009 to “One World Trade Center” due to concerns that the owners had about trying to attract tenants to a site that was so “emotionally charged” (Rose 2013<sup>[6]</sup>). It was also consciously built as a 1,776 foot tall tower to echo the year of America’s Declaration of Independence (Rose 2013<sup>[6]</sup>).

In contrast to the first two cases selected for this paper, One World Trade Center (One WTC) was built in the age of the internet, which both broadens and complicates the media analysis. In addition to multiple media sources, the published names of the experts involved has grown and expanded. In contrast to the “four men” who were given responsibility for the Empire State building, Goldhagen (2015<sup>[6]</sup>) notes the names of seven individual architects, nine different types of engineering firms, five consulting firms, and one builder.

### Architect (Libeskind => Childs)

Much as the U.N. Secretariat before it, ideas for rebuilding on the site of the original Twin Towers were initially submitted by several architectural firms. From these site plans, Daniel Libeskind was declared the master planner for the site in February 2003. However,

within three months, the developer, Larry A. Silverstein, selected a different architect and architecture firm—David Childs of Skidmore Owens & Merrill (SOM)— to design the building on the site. The Libeskind and SOM designs proceeded concurrently through 2003. Libeskind’s 1776 foot tall design first proposed offices reaching to the 64th floor and a freestanding spire filled in with trees, later modified to a fused spire with offices reaching to the 70th floor. Child’s design was a twisted 2000 foot tower with offices to the 64th floor topped by wind turbines and antennas. By the end of 2003, the two designs merged as Libeskind agreed to collaborate with Childs. But in July of 2004, Libeskind sued Silverstein for \$843,750 in unpaid architectural fees (Dunlap 2004<sup>[6]</sup>). In October 2004, the lawsuit was settled for \$370,000 (Greenspan 2013<sup>[6]</sup>). By 2005 Libeskind seemed to have had a change of heart, releasing a statement saying that Child’s redesign in response to police department requests was “even better than the tower we had before” (Greenspan 2013<sup>[6]</sup>). Neither Libeskind’s trees nor Child’s wind turbines survived the value-engineering process that resulted in the final design. Although the design concept was intended to achieve a Leadership in Energy and Environmental Design (LEED) gold accreditation, a rating application was never submitted. The only overtly “green” feature of the building was a fuel cell which was destroyed during the 2012 hurricane named Sandy, before the building was even completed (Vidaris 2017<sup>[6]</sup>).

### Engineers (8 + WSP)

Goldhagen (2015<sup>[6]</sup>) notes nine different types of engineering firms involved in One WTC. These include: WSP (structure), Jaros Baum & Bolles (m/e/p, sustainability); Steven Kinnaman & Associates (vertical transportation); Weidlinger Associates (protective design engineer);;



Schlaich Bergermann und Partner (spire/cable net wall structure); Philip Habib and Associates (civil and transportation); Mueser Rutledge Consulting Engineers (geotechnical); Vidaris (facades); LERA Peer Review and Historic Structures (peer review). This project is listed first on the Schlaich Bergermann website project list (sbp 2017<sup>[1]</sup>). It is the first of six scrolling pictures on the Jaros, Baum & Bolles website (JBB 2017<sup>[1]</sup>). It is listed without particular prominence amidst other projects at the remaining firms. (SKA 2017<sup>[1]</sup>, PHA 2017<sup>[1]</sup>, MCRE 2017<sup>[1]</sup>, Thornton Tomasetti 2017<sup>[1]</sup>, Vidaris 2017<sup>[1]</sup>, LERA 2017<sup>[1]</sup>).

Despite so many engineers being involved, only WSP makes a feature of their work on the building by producing and hosting an 8:40 minute YouTube video called "Engineering an Icon" on its website (WSP 2015<sup>[1]</sup>, 2017<sup>[1]</sup>). Interestingly, WSP's involvement is deliberately described as collaborative rather than monumental. No quotes from WSP engineers are featured on the WSP website. Instead, it features a quote from the architect's managing partner, T.J. Gottesdiener: "We tried to make it look as clean, strong, monumental as possible and that meant making it look as simple as possible – although this is far from a simple building."

WSP's video includes statements from "key members" of the design team. The "Engineering an Icon" video opens with a full minute of interviews with Steve Plate, the director of One WTC construction for the Port Authority of New York and New Jersey (the client); Judith Dupré, writer and "official" biographer of One WTC; Mike Mennella, an executive vice president at Tishman Construction; and T.J. Gottesdiener from SOM. Ahmad Rahimian, WSP's Director of Building Structures, and Yoram Eilon, its Vice President for building structures, enter the video only after the other participants have been introduced. Rahimian and Eilon take 15 seconds for a shared quote where Rahimian says "The entire engineering community, the construction community, basically went back into a soul searching" and Eilon adds "We had to think what it means, what is expected from us, not only by the developer but primarily by the public." Later in the film they discuss the importance of going beyond code for public safety and the strength of the 14,000 PSI (pounds per square inch) concrete. Together Rahimian and Eilon speak for less than 25% of the total video time, and these comments concentrate largely on the strength of the building's concrete core. This core is one of the most important innovative features of the enhanced focus on safety due to the 9/11 attacks (Glanz 2014<sup>[1]</sup>).

Despite the importance of this innovation, WSP's video about One WTC clearly signifies a particular positioning with respect to other professional groups (WSP 2015<sup>[1]</sup>). It shows the engineers recognizing the prominence of architectural design, crediting the roles of other stakeholders, and fitting their achievements neatly within this envelope.

### **Builders (Daniel Tishman & Port Authority workers)**

Building One World Trade Center took almost 11 years, from October 2004 to May 2015. It was contracted out to Daniel Tishman, of

Tishman Construction. This family-held firm originated in 1898. It built the original Twin Towers, as well as New York's Madison Square Garden, and Chicago's John Hancock Center. Daniel Tishman sold his family business to AECOM 6 years into the 11 year process of building One WTC (Korman 2010<sup>[1]</sup>).

As with the U.N. Secretariat, little newspaper space is devoted to the builders—since most is absorbed by the architectural squabbles—but there is some online presence in the form of videos. One YouTube video shows this 11 year span collapsed into just two minutes, set to triumphant orchestral music (Earthcam 2015<sup>[1]</sup>). Another a short documentary interviews workers about how it feels to work on One World Trade Center (WorldsearchFilms 2010<sup>[1]</sup>). Individual builders talk about their feeling of pride and the vast amount of materials they used, but the nature of the story is fragmented and piecemeal compared to the grand unified challenge represented in media stories about the Empire State Building.

### **Synthesis**

As Goldhagen (2015<sup>[1]</sup>) describes, One WTC had a lot to live up to. One WTC was "a singular project, larger than its clients, financiers, architects, and tenants; larger even than survivors' families and New York City's residents. One WTC is a project fraught with the agony of meaning. Everyone had every right to expect a major civic icon. Which we did not get. This is a fair-to-middling commercial office building with some notable good features." For the thousands of people involved in its inception and the massive public expenditure the rebuilding effort took, the result seems less than inspirational (Charney 2014<sup>[1]</sup>). Dupré, the building's self-proclaimed biographer, concludes the WSP video (WSP 2015<sup>[1]</sup>) by saying: "Every time I see One WTC, I feel a surge of pride. As a New Yorker, I almost feel maternal for this tower. This giant...[the] tallest tower in the western hemisphere. But it inspires love. It's beautiful. It does what it set out to do. It's tall, it's strong, it's humble. It is luminous. And it changes constantly. It's beautiful."

Interestingly, a promotional video on the One WTC website titled "Be Inspired" counters both the lack of a distinctive design and the absence of sustainable features. The video chronicles a fictitious tale of solar financing portrayed by three imaginary One WTC tenants who produce a new form of solar cell to power a satellite. This project simultaneously provides noteworthy financial returns while delivering internet access to female campers in the forest, children on a beach, an old man in a mountainous area, and researchers in a frigid landscape, to the great joy of a crowd in Tokyo (onewtc 2017<sup>[1]</sup>). Its concluding comment is: "become greater than the sum of your parts: rise!" This sentiment aptly summarizes the main result of One WTC's long and troubled gestation, while glossing over its drawbacks. It is neither the most beautiful nor the most sustainable building in the western hemisphere, but it is currently the tallest





## Discussion and Conclusions: Back to the Future

This paper considered three cases of prestige skyscrapers in New York City—the Empire State Building (1931), the U.N. Secretariat (1952), and One World Trade Center (2014). It contributes to this special issue by examining how architects, engineers, and builders created skyscrapers that carry and convey different social meanings. It asked the question: *what* is being sustained by the production of these prestige skyscrapers and *by whom*? The paper shows that the craft of builders was valued in its own right the 1930s, architectural design ideas were at the forefront in the 1950s, and engineers back-led a structure of unprecedented strength in the 2010s. This concluding section brings the history of these skyscrapers into the present and considers how the fragmentation or integration of building professions (de)constructs environmental sustainability.

In the twenty-first century, the Empire State Building continues to host statements about the importance of building trades. In addition to the original Art Deco plaque honoring workers in the lobby, construction workers are an integral part of the “Dare to Dream” exhibit on the 80th floor (Levy 2015<sup>[6]</sup>), and builders are also described in a Apple-iOS app (Empire State Realty 2017a<sup>[6]</sup>). In addition to focusing attention on the triumphs of its builders, the current owners recently added environmental sustainability to the building’s list of achievements. In 2009-10, the Empire State Building underwent a high-profile energy renovation with a team that included the Clinton Climate Initiative, Johnson Controls, JLL, the New York State Energy Research and Development Authority, and Rocky Mountain Institute (Empire State Realty 2017b<sup>[6]</sup>). Notably, part of the renovation’s purpose was sharing lessons learned with other multi-tenanted office buildings. It was a multi-stakeholder process that included “engineers, property managers, energy modelers, energy efficiency experts, architects, and building management” (Empire State Realty 2017c<sup>[6]</sup>). The sustainability renovation is featured as a public exhibit on the 2nd floor and on the building’s iOS app. The Empire State Building’s environmental sustainability program continues to promote doing over design by emphasizing integration across professions and transparency to other office buildings and the public.

Since its inception, the U.N. Secretariat has provided a fitting backdrop for the work of the U.N., which has been called the largest and most familiar non-governmental organization in the world (National Geographic 2017<sup>[6]</sup>). Its iconic image—the concave white curve of the assembly building beneath a slender rectilinear glass tower, with a row of national flags in front—has been featured in a number of TV shows and movies. In terms of the environment, the U.N. started a broad, cross-agency sustainability program called “Greening the Blue” in 2007 (UN 2017<sup>[6]</sup>), which focuses mainly on environmental management reporting. It also initiated a renovation of the Secretariat in 2008, which was supposed to contain “a hint” of green: the Secretariat’s glass curtain-wall was supposed to be re-glazed using building-integrated photovoltaics (BIPV)

to generate solar electricity (MacFarquhar 2008<sup>[6]</sup>). A later article, however, confirms that the actual renovation of the curtain-wall did not follow this path (Heinteges & Associates 2017<sup>[6]</sup>). The new glass increased safety and reduced infiltration, as well as matching the historic color, thickness, and sheen, but it did not implement BIPV. Sustaining the iconic image of the building was prioritized over environmental considerations, privileging architectural design over action.

The building biographer of One WTC claims it “inspires love”, but architectural critics disagree. One WTC has not yet withstood the test of time or a terrorist attack, but it is certainly designed to be both strong and safe. The 14,000 PSI WSP-engineered concrete core points toward yet another form of sustainability: resilience against attack and explosives. The building is engineered to sustain itself and its inhabitants. In terms of environmental sustainability, the building had a *goal* of achieving LEED gold accreditation. This goal is featured on one of the engineer’s websites (Vidaris 2017<sup>[6]</sup>), even though it did not become a reality.

It is unlikely that the professional dynamics between architects, engineers, and builders will return to the kind of coordination that marked the Empire State Building, because these professional groups no longer expect (or call for) harmonious interaction with each other. In the 2010s, the WSP engineers created a video that performs this integration, but the newspaper stories and academic research show a much more fraught and difficult process (Charney 2014<sup>[6]</sup>). Indeed, the design process for skyscrapers seems to have become more fragmented and onerous over time rather than less. The Empire State Building took 11 months to build, the U.N. Secretariat took 3 years, and One WTC took 11 years. The Empire State Building formally recognized the achievement of 32 different trades. Press from the U.N. Secretariat focused on international architects, not builders or engineers. The list of participants in One WTC recognizes only one builder but seven individual architects, nine different types of engineering firms, and five consulting firms. Over time, these cases show a shift in focus from the importance of *doing* to *designing*, both in the reduction of media stories about builders and the rise in the number and types of designers. Both the formal qualities of skyscrapers and their functional efficiency may suffer due to this fragmented and compartmentalized approach to design and construction.

Proponents of green, sustainable, and energy efficient designs often advocate for what is called “integrated design” (Yudelson 2008<sup>[6]</sup>). This is a change in the typical linear design process which starts with an architect and ends with the builder. Integrated design gives “each speciality the opportunity to participate fully, even in areas where they don’t possess particular expertise [...] to help realize better sustainable design solutions” (Yudelson and Meyer 2013:30<sup>[6]</sup>). A key feature of integrated design is ensuring that the builder is included at the outset of design process to provide insights into the constructability and cost of the project. Builders



contracted to manage complex construction projects are estimated to spend 90 percent of the project budget and coordinate dozens of trades, yet typically they do not participate in schematic design discussions. In the cases presented here, only the earliest case—the Empire State Building—followed an integrated design process. Optimally, a fully comprehensive integrated design process would also include future building operators and occupants (Yudelson and Meyer 2013<sup>[9]</sup>), treating the whole building and its occupants as an evolving and durable ecosystem.

How might the fragmentation in the construction industry be shifted? The WBCSD calls for a new “system integrator” profession (WBCSD 2009<sup>[9]</sup>) to bridge operational islands (see Figure 1). In smaller projects, such as home refurbishment, builders may be able to play this role (Janda, Killip, and Fawcett 2014<sup>[9]</sup>, Janda and Killip 2013<sup>[9]</sup>). In larger projects, like skyscrapers, it is difficult to imagine how a single existing profession would expand to successfully cover the gaps. Builders claimed this territory in the 1930s, but it seems anachronistic to believe they will hold this role again. As envisioned by Reinhard’s manifesto from 1932, architects have claimed this territory. Their ability to successfully defend it, however, is based on the current social focus on goals and ideas rather than outcomes. For example, architects have successfully taken credit for designs that are unbuilt and even unbuildable (Harbison 1991<sup>[9]</sup>). As designers themselves, engineers may be better situated than builders to challenge architects for control of the current system. However, the subtle performance of the engineers in the WSP video suggests they may continue to cede this role to architects.

For builders to gain more professional credit for their work, Abbott’s system of professions theory suggests that they would need to claim a socially accepted problem. This means not just a change in the way that work is performed, as suggested by the advocates of integrated design, but a change in the way that their jurisdiction is seen by society. For society to refocus on the problems of *doing* rather than *designing* could require a greater appreciation of outcomes rather than goals. A good start in this direction may be reconfiguring the nature of sustainability research itself. Janda and Topouzi (2015<sup>[9]</sup>) argue that most sustainability research follows a “hero story”, exhibiting a pattern similar to Joseph Campbell’s classic text about the hero monomyth (Campbell 1968<sup>[9]</sup>). In this story form, it is perfectly normal to claim idealized benefits that are not substantiated in reality: like LEED accreditations that were never actually submitted, or benefits from photovoltaic panels

that were never installed. These authors suggest sustainability in practice would be improved by implementing a system of stories that reflect more of a building’s longer lifecycle. The “hero story” can continue to focus on design process and projections, “learning stories” could tell what happens in practice by comparing design ideals to reality, and “caring stories” could show the importance of maintenance, use, and renovation.

The cases examined in this paper show that the American system of professions in the construction industry produces environmentally unsustainable skyscrapers. Of the three cases considered here, only the earliest example, the Empire State Building, goes beyond the “hero story” of its original inception by making its sustainability renovation both public and transparent. Reorienting the current system of professions—through greater integration, new leadership, or different social meanings—to favor the social production of sustainable buildings is an important evolving area for future transitions research.

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#### Biography

Kathryn Janda is an interdisciplinary problem-based scholar who studies energy demand innovations, organizational change, and non-domestic buildings. She is a Principal Research Associate in the Energy Institute at University College London; a Guest Professor, Department of Thematic Studies – Technology and Social Change (*Tema T*), Linköping University, and a Senior Research Fellow at the Environmental Change Institute at Oxford University.

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# BETWEEN CRAFT AND REGULATIONS

## *Experiences with the Construction of Two “Super insulated” Buildings in Norway*

by Ruth Woods & Marius Korsnes

*The Norwegian government uses building regulations to influence the construction industry, and they directly affect how craftspeople from the industry apply their skills. In this paper, we investigate the negotiations between the meaning and value associated with the requirements for the material structure and the craftspeople’s role. Two houses in Central Norway are the starting point, where qualitative methods, primarily semi-structured interviews and observation, are used to gain insight into the craftspeople’s view of the building regulations. The houses represent two different building standards. A Passive House in Åfjord Municipality, completed in 2014, and ZEB Living Lab in Trondheim, a zero emission building (ZEB), completed in 2015. In Norway, the building regulations are reviewed every five years. In 2011, craftspeople were constructing buildings to the low-energy standard. This led to an increased focus on “super insulating” building techniques during the period 2013–16 when the case studies took place. Starting with a craftspeople’s view, this paper asks what implications the increasing demands for energy efficient and environmentally friendly buildings have on the role of the craftspeople and their application of skill. The construction industry bases much of its activity on Norwegian construction traditions and skill; and this guides the development of new generations of buildings. The paper shows that the use of established skills and knowledge is both a strength and a challenge when dealing with a new set of building regulations. Skill is a resource to build upon, but it is also influenced by a conservatism that has difficulties getting beyond the extra time and costs associated with new regulations. It can therefore function as a barrier to the use of construction crafts to establish more sustainable building forms within the Norwegian market.*

**Keywords:** *craft, building regulations, Passive House, zero emissions, skill*

**Authors:** **Ruth Woods**  
*Postdoctor*  
SINTEF, Building and Infrastructure, Trondheim, NORWAY  
**Marius Korsnes**  
*Postdoctor*  
NTNU, Department for Interdisciplinary Studies of Culture, Trondheim, NORWAY

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## Introduction

The EU roadmap from 2011 proposes that the better construction and use of buildings could influence 42% of final energy consumption, about 35% of our greenhouse gas emissions and more than 50% of all extracted materials (EU Roadmap 2011<sup>[1]</sup>). The same roadmap proposes that by 2020 all new buildings should be nearly zero-energy and highly material efficient. In Norway, this ambition has been manifested through a 2012 White Paper stating that building regulations should reach nearly zero energy by 2020. The Norwegian white paper “Good buildings for a better society” indicated that all new houses should fulfil Passive House level from 2015 (Ministry of Local Government and Regional Development 2012). During the past five years the introduction of Passive House and zero emission buildings (ZEB) in Norway has escalated, and this has impacted on engineers, designers, architects, craftspeople, and the people inhabiting these buildings. The EU Roadmap and Norwegian building regulations from 2011 have led to the development of building concepts that are “super-insulated”, reducing space-heating requirements (Georges et al. 2017:7<sup>[1]</sup>). Users have been known to call these super-insulated buildings “plastic bag” houses—saying something about the controversy associated with these very airtight and highly insulated buildings<sup>2</sup>. Two “super-insulated” buildings in Central Norway provide insight into the production of meaning surrounding the role of craftspeople when building energy and material efficient houses. The buildings allow a consideration of the construction process, their material form and the interpretation of the building regulations. If we are to live less energy and CO<sub>2</sub> intense lives in the future, then how we build is expected to change. Understanding how craftspeople are involved in the construction of low-carbon and energy houses will provide useful knowledge when crafting future sustainable buildings. The intention here is to describe the changing role—if any—of craftspeople in Norway based on the craftspeople’s response to the process of constructing two sustainable buildings. Thus, this analysis increases our knowledge about the way in which climate knowledge is negotiated, as it is manifested in new building regulations and how it aligns with craftspeople’s experiential knowledge.

Central within this analysis are the Norwegian building regulations and standards, and how the implementation of technical requirements found within the standards influences the construction process and a craftspeople’s use of skills and knowledge. Building regulations change, within the period described in this paper, 2013 – 2016, a new standard, the Norwegian Passive House standard was increasingly taken into use, and a new set of building regulations was under development, what eventually became TEK17<sup>3</sup>. The Norwegian government uses the building regulations as guidelines for the construction industry<sup>3</sup>. The regulations establish

the minimum of technical requirements necessary in order for a building to be lawfully registered as a building. They may, however, also be understood as the maximum requirements and as such may not necessarily function as incentives for the construction of buildings that are more energy efficient (Ryghaug and Sørensen 2009:987<sup>[1]</sup>). In an analysis of why the building industry has failed to build more energy efficient in Norway, Ryghaug and Sørensen (2009<sup>[1]</sup>) suggest three main reasons: deficiencies in public policy, limitations in governmental regulations and a general conservatism in the building industry (Ibid.: 984). This combination hints at the challenges faced by craftspeople.

The construction industry is under pressure to build more sustainably. The understanding of sustainability used here focuses particularly on buildings, and suggests limiting the negative environmental impact of buildings through how materials, energy and space are used. Based on a survey of sustainable building definitions, Berardi (2013<sup>[1]</sup>) suggests that a sustainable building can be defined as “a healthy facility designed and built in a cradle-to-grave resource-efficient manner, using ecological principles, social equity, and life-cycle quality value, and which promotes a sense of sustainable community” (Berardi 2013:76<sup>[1]</sup>). Sustainability is therefore not just about reducing energy consumption; it also affects the materials included, the construction process itself and the way the building is used.

The demand for greater sustainability in buildings is influencing building regulations. Since the 1990’s the Norwegian regulations have been revised approximately every five years. In 2011, the Norwegian Directorate for Building Quality (DiBK) stated that the Norwegian building stock “accounts for about 40% of domestic energy consumption in Norway. The building industry is therefore an important player in the effort to reduce the country’s overall environmental impact from energy use.” (DiBK 2011<sup>[1]</sup>). Achieving greater sustainability in buildings has often meant reducing energy use, particularly space heating and this has caused the emergence of building concepts that are based on super-insulated walls, floors and roofs, such as the Passive House standard (Georges et al. 2017:7<sup>[1]</sup>).

In 2011, the regulations supported the construction of “Low-Energy Housing”, but the next set of regulations was already under discussion and the Passive House standard was expected to be part of the forthcoming regulations. Norway introduced its own Passive House standards for residential buildings and non-residential buildings (NS 3700) (NS 3701) in 2010 and 2012. A Passive House requires approximately 25 % of the heating necessary for a house built according to the previous Norwegian regulations (Standard Norge, 2010<sup>[1]</sup>). In order to achieve low energy-use the building envelope

1 <https://brage.bibsys.no/xmlui/bitstream/handle/11250/2455760/masteroppgavelinlyngstad.pdf?sequence=1&isAllowed=y>

2 TEK15 was planned but it was not approved until 2017 and the final version of the building regulations thereby became TEK17 <https://dibk.no/byggereglene/byggteknisk-forskrift-tek17/>.

3 <https://dibk.no/byggregler/tek/>



is more insulated and windows are triple-glazed. The Norwegian Passive House standard NS 3700 also includes airtightness requirements. The regulations aim to ensure that the measures that are planned and implemented take into consideration good visual quality, universal design and meet technical requirements for safety, environment, health and energy (DiBK 2017<sup>[4]</sup>). Amendments were made to the regulations in 2016, changes include, increased energy requirements, stricter demands for energy components and fossil fuel heating is no longer permitted. The construction industry is currently interpreting the amended regulations in practical terms. The Norwegian Low-Energy program, which disseminates energy effective solutions for buildings to the construction industry, states that "In practice, the new energy requirements mean better

windows (U-value 0.8), better density (leakage number 0.6), better insulated floors, a larger window area, and reduced thermal-bridge values"<sup>4</sup>. Concepts for the Norwegian Zero Emission buildings (ZEB's) are also based on super-insulation.

The paper is structured as follows: Section 2 presents the meaning and value associated with craft, and discusses the craftsperson's relationship with the building regulations. Section 3 describes the two houses and the social and technical systems around them and then presents the methodology used. Section 4 presents some of the narratives associated with the two houses. The Passive House in Åfjord is presented first and ZEB Living Lab completes the section. Section 5 provides a discussion and some concluding analysis.

## Crafts, Meaning and Sustainable Buildings

This paper centres on the relationship between concepts and things (Henare et al. 2007:2<sup>[5]</sup>). It is suggested here that there is a close association between the process of constructing a building and the meanings associated with the same building. The interaction between the craftsperson, the building and the building regulations are considered, because it is not simply the material context that is affected by changes in the requirements for buildings. They also have an impact on how a craftsperson applies their skill, the meaning and value surrounding a building and its use, and the expected sustainability-outcomes.

Craft is easily associated with tradition, weaving, pottery, stone masonry and the fine arts of painting and sculpture, but if we look at the actions that define a craftsperson, the term may be associated with a much wider variety of activities. Craft, according to Sennett (2008<sup>[6]</sup>), is not associated with particular fields, methods or tools used; it is about the attitude to the work. Craftpeople who are "dedicated to good work for its own sake" represent "the special human condition of being engaged" and take "pride in their work" (Sennett 2008:20<sup>[6]</sup>). We recognised this attitude or work ethic among craftpeople from the construction industry and those who were involved in constructing the two houses presented here.

A work ethic requires an activity and in the craftsperson's case, the starting point is skill. Skill is routine and experienced practice, which contrasts with sudden inspiration (Sennett 2008:37<sup>[6]</sup>). Learning a skill requires repetition, but once a skill is in place it offers control over materials and tools. The craftsperson follows the materials and task "while bending it to their evolving purpose" (Ingold 2009:92<sup>[7]</sup>). Skill is social and it connects to predecessors and to our fellows (ibid.: 22). Skills are passed from craftsperson to craftsperson, but this does not mean they are rigid. A craftsperson interprets drawings and finds solutions based on knowledge, materials and skill that may be outside the expectations of what is planned. In the construction industry, a craftsperson is working with materials that

may not willingly fit into the required forms, or remain in them (ibid.: 93). A carpenter follows the materials, the way they change due to wear and tear, and as their form changes, for example, from wooden planks to the surface of a floor. This experienced knowledge exists in parallel and sometimes in contrast to requirements put down in novel building regulations and will be explored in more detail here.

The construction industry is in general described as a fragmented, but complex social context, which is in large part due to the numerous small to medium sized actors which are part of the industry (Van Bueren and De Jong 2007:554<sup>[8]</sup>). Some recent research focuses on craftpeople who are part of the social context within low carbon construction, e.g. focusing on the role of retrofit advisers (Owens et al. 2014<sup>[9]</sup>), middle actors or building professionals (Parag and Janda 2014<sup>[10]</sup>) and heating engineers (Wade et al. 2016<sup>[11]</sup>). In the face of increasing attention to reducing energy use in buildings and increasing the sustainability of the building stock, this research is in general is pertinent. Nevertheless, as pointed out by Wade et al. (2016:40<sup>[11]</sup>) 'building professionals and practitioners remain under-investigated in energy and building research'. In Norway too, research has been scarce on the role of craftpeople during the construction of sustainable buildings, or on how their use and interpretation of the building regulations influence this process. This in despite small and medium sized companies also dominating the Norwegian industry (Ryghaug and Sørensen 2009:988<sup>[12]</sup>). A more common strategy, both in and outside Norway, has been to consider the actions of those designing and developing buildings, the architects and engineers (Gunn 2006<sup>[13]</sup>, Andresen and Hegli, 2016<sup>[14]</sup>, and Stender 2017<sup>[15]</sup>). It is suggested here that greater focus on the craftsperson, someone often working in smaller construction companies, may provide the background to understand and deal with the conservatism mentioned in the introduction.

In a qualitative analysis of the energy efficient renovation of single-family homes, Risholt and Berker (2013<sup>[16]</sup>) stated that the craftsperson in their role as an expert during the renovation process

4 <http://lavenergiprogrammet.no/artikkel/nye-energikrav-i-byggteknisk-forskrift/>



might actually be a barrier to achieving a more energy efficient dwelling. This could be related to limited knowledge about innovative products and a focus on cost (Risholt and Berker 2013:1028<sup>[5]</sup>). Ryghaug and Sørensen (2009:988<sup>[6]</sup>), state that innovation within the construction industry is limited and propose that greater focus on innovation, through research and design, will support efforts to improve energy efficiency in buildings, but that the building industry scores low on research investment. This seems partially due to the majority of companies within the construction industry being small to medium sized. Van Bueren and De Jong (2007<sup>[7]</sup>) propose a “continued coupling between research and practice” as a solution to the distance between policy and the construction industry. The use of pilot projects to encourage dissemination is another solution to the lack of interest in research investment. Presenting real-life examples in the form of pilot buildings that are developed, tested and used by different actors, craftspeople and others, from the construction industry (Gustavsen 2017<sup>[8]</sup>, Andresen 2017<sup>[8]</sup>)<sup>5</sup>.

The meaning surrounding the role of craftspeople in the construction industry is closely associated with the buildings that they construct. The insides and outsides of buildings are various,

differentiated spaces allotted to different intentions. The construction of a building is part of the meaningful complex, adding to or replacing existing understandings about what buildings do and how they may be used. The building of a house, a school or an office building, is intentional action that is future orientated (Gell 1998:255<sup>[9]</sup>). How we build and what we build can affect the way we live. For example, the way the Passive Houses are heated and ventilated. However, the built form is not necessarily understood in a single way, there exist differing attachments or commitments to what initially appear to be the same mutually intelligible phenomenon (Buchli 2013:16<sup>[10]</sup>). Building regulations, Passive House and zero emission definitions offer further variations to our understandings about buildings, and have the potential to play many different roles in social life (Miller 1983:201<sup>[11]</sup>). These are converging with understandings about sustainability, reduced energy and material use, as well as demands for increased comfort levels that are circulating in society. In this paper, we want to investigate further, how craftspeople experience these negotiations. Thus, we discuss negotiations between the meaning and value associated with the requirements for the material structure and the craftsperson’s role.

## Overview of the two cases and methodology

Having introduced the theoretical underpinnings of this paper, we now briefly introduce the two cases, the Passive House in Åfjord and ZEB Living Lab, and our research methods. The two projects took place independently of each other, but are considered together because they both look closely at the activities of craftspeople within the construction industry in Norway. The data collection for Åfjord took place in 2012-2013 and in ZEB Living Lab in 2015. Both cases in this paper are pilot projects and are intended to function as inspiration for craftspeople and homeowners, and by ‘dazzling’ the beholder (Gell 1998:44<sup>[12]</sup>) showcasing a realised manifestation of a the ‘future home’.

Living Lab and the Åfjord Passive House have both been used to gather and disseminate knowledge to craftspeople from the construction industry. The two pilot buildings are otherwise different in concept, scope and aims. The ZEB Living Lab is used to gather new knowledge about zero emission buildings and aims to support the establishment of zero emission buildings as a viable concept, nationally and internationally. The Åfjord project primarily aimed at communicating existing knowledge about Passive Housing and developing an educational program that would disseminate knowledge in local communities in Central Norway<sup>6</sup>.



Figure 1: Passive houses at Vassneset in Åfjord Municipality. (Eggen Architects 2012)

The Åfjord project aimed to provide both reasonably priced social housing for the municipality and a practice-based program to teach high school pupils the skills necessary to build Passive Houses<sup>7</sup>. The course program developed followed the same progression as the construction process. The house was located in Åfjord on the Vassneset site and was built for multi-handicapped members of the community. It is single story, universally designed, with a floor area of approximately 70 square meters, which includes the space for the storage of wheelchairs and other specialised equipment<sup>8</sup>

5 The case studies in this paper are pilot buildings. See description from page 5.

6 The Norwegian Housing Bank coordinated collaboration between Åfjord High School, the Program for Construction Education, and SINTEF Building and Infrastructure. The pilot building in Åfjord inspired four other building and education projects in different municipalities within central Norway (Woods et al. 2013b: 10).

7 The Norwegian high school is three-year period of education normally starting when the pupil is sixteen and is completed at the age of nineteen.

8 The houses in Åfjord were finished after the research project was completed, and no residents were interviewed.



Figure 2: ZEB Living Lab, January 2016 (architect, Luca Finocchiaro)

Zero-emission buildings (ZEB) suggests the next stage in the building regulations after Passive Houses. A ZEB requires less energy for heating than a regular building because, in a similar way to a Passive House, the building envelope is more insulated and the ventilation system more effective for heat recovery. In addition, the house is able to supply its own energy needs and the building materials, preferably have, low carbon emissions. The ZEB concept aims to achieve a minimum of CO<sub>2</sub> production through energy and materials used. ZEB Living Lab is a single-family house with a heated floor area of approximately 102 square meters<sup>9</sup>. The house integrates state-of-the-art technologies for building envelopes, building equipment, solar energy exploitation, heating and ventilation systems, and control interfaces<sup>10</sup>.

The two pilot projects aim to extend the knowledge within the construction industry by reaching out to craftspeople directly through dissemination processes and, in the case of the ZEB pilot, by attempting to influence building standards. At the time of their construction both houses were at the forefront of building regulations and the challenges met by the craftspeople working on their construction highlight the changes affecting craftspeople in general. A ZEB is in many ways a Passive House that has added a renewable energy source allowing it to supply its own energy needs. Building upon Passive House technology ZEBs suggest the future of sustainable housing. Living Lab therefore provides insight into what has happened to Passive House knowledge, and the expectations about future building regulations.

### Data collection and analysis

An anthropological approach relevant to meeting craft in the field is one that through participating in routine activities bridges the distance between experience and analysis, simplifying the encounter with a multitude of meanings connected with the construction

process (Henare et al. 2007:4<sup>[9]</sup>). This suggests an ideal, but participating in routine activities is not always possible and this was the case when following the building process connected to the two houses presented here. Methods have been used which offer routes into understanding people's lives, experiences and values, but which are not necessarily associated with the classic observational approach (Pink 2009:9<sup>[10]</sup>). This paper is based on three main types of data: Observation, semi-structured interviews (face-to-face and telephone) and a focus group interview. Observation took place in the context of different social fora organised around the construction of the two buildings. We followed the construction process and gathered stories about the buildings from craftspeople and people associated with the design and use of the two houses. Observation provided opportunities to follow and understand the construction processes taking place. The opportunities for observation were part of the practical and social context, and provided the research team with the background to understand the interview data presented in the paper.

In Åfjord observation took place within the framework of a series of classroom presentations and site visits which normally lasted the length of a school day. These often had a workshop format and followed a linear process where teachers and pupils received information about Passive House construction and were given practical or theoretical problems to solve or discuss. In ZEB Living Lab, the fora for observation were mostly shorter (hour-long meetings) or short informal site visits (during the construction process). Site visits depended on the activities taking place in the building. It was important not to disturb the craftspeople at work or hinder their progress. The length of the interviews in both projects varied depending on the informant. The shortest interviews were with the pupils from Åfjord High School and lasted thirty minutes. The longest interviews were with craftspeople from Living Lab and lasted almost two hours. The time and place for the interviews and themes to be covered by the interview were agreed upon prior to the interview. The interviews and other fora are presented in tables 1 and 2.

The craftspeople from the two cases presented here, are mostly men. There are women working in the Norwegian construction industry. In 2017 of the total working in the construction industry 22% were women<sup>11</sup>. Only one of the craftspeople working on the two houses were women. It should also be noted that the term in Norwegian is gender-neutral as it (håndverker) refers to a manual worker, i.e. using his/her hands. All the craftspeople who took part in the Åfjord and ZEB Living Lab projects are anonymous, when presenting their narratives or comments, and to be able to present them individually, we have given each of the craftspeople referred directly to, in the paper a pseudonym<sup>12</sup>. The majority of informants from both

9 ZEB Living Lab is a residential research laboratory where user behaviour may be studied in interaction with zero emission technology. Six groups of people lived in ZEB Living Lab, from October 2015 to April 2016 (Korsnes 2017; Korsnes et al. 2017).

10 For a more technical description of ZEB Living Lab see Goia et al. (2015).

11 <https://www.ssb.no/befolkning/nokkeltall/likestilling/29.05.2017>

12 Both projects were reported to the Norwegian Centre for Research Data, which specifies rules for anonymity and data storage <http://www.nsd.uib.no/nsd/english/index.html>.





case studies were experienced craftspeople, who had worked in the construction industry for a number of years. Exceptions to this rule are the two school pupils who were interviewed in Åfjord and who began their apprenticeships during the autumn in 2013. In ZEB Living Lab, most of the automated engineer's experience was within a laboratory context. He had no experience of building automation within houses or offices outside the university campus.

TABLE 1

#	Informant/ interviewee	Number of people	Type of data
1	Teacher	1	One semi-structured interview
2	Teacher and carpenter (Jan)	1	Two semi-structured interviews. One in 2013 and one over the telephone in 2017
3	Pupil (Martin)	1	One semi-structured interview
4	Pupil (Kristin)	1	One semi-structured interview
5	A project manager and a carpenter	2	Observed discussion at a construction site
6	Pupils, teachers and craftspeople	30	Five organised workshops at construction site with observation

Table 1: Overview of data collection in Åfjord Passive House

The Passive House course in 2012 and 2013 in Åfjord Municipality provided opportunities to interact with experienced craftspeople (teachers and members of the local construction industry in, and around Åfjord, during on site meetings and in classroom situations) and high school pupils who had not yet begun their careers<sup>13</sup>. In addition, we interviewed two pupils and two members of the teaching staff at Åfjord High School. As part of the coursework, pupils and teachers went on a fieldtrip where they visited the building site for what was then Scandinavia's largest Passive House estate. The dialogue between researchers, pupils, the housing estate's project manager and one of the three craftspeople working on the site, who guided us around the building site, is also part of the dataset. The Åfjord project took place when Passive House was expected to become the new housing standard, but before the current 2017 regulations came into effect. At that time there were still relatively few Passive Houses built and in use. The data collection in 2012-13 emphasised the pupil's learning process, the building regulations themselves were not the focus of the project. The Åfjord case provides background to understand changes that were taking place to the building regulations and how these were being implemented by craftspeople from the construction industry. A follow up interview with one of the teachers from Åfjord, who still teaches practice based Passive House construction, took

place in 2017 and is included in the dataset. This interview looked back on the changes in the building regulations and the activities of the craftspeople between 2012 and 2017.

In the case of ZEB Living Lab eight craftspeople involved in the last phase of the construction in 2015 agreed to be interviewed, a carpenter, an automation engineer (responsible for programming the technical systems), an engineer who specialises in solar technology, the architect and three electricians. The semi-structured interviews took place while we were preparing for a residential experiment in Living Lab. We also had meetings and conversations with several of the engineers involved in designing the lab, and with electrical engineers at campus management responsible for operating the building, (the most pertinent are presented in table 2). Prior to the completion of the house, we visited the building site, saw the craftspeople in action and observed discussions.

TABLE 2

#	Informant/ interviewee	Number of people	Type of data
1	Carpenter (Petter)	1	One semi-structured interview
2	Automation engineer (Emil)	1	One semi-structured interview
3	Solar engineer (Ola)	1	One semi-structured interview over Skype
4	Architect	1	One semi-structured interview
5	Two electricians (Espen & Ove) and one HVAC engineer	3	Focus group interview
6	Electricity engi- neer, campus management	1	One semi-structured interview over telephone (2016)
7	Electricity engi- neer, campus management	1	One semi-structured interview over telephone (2016)
8	Carpenters, electri- city engineers, building physicist from NTNU, auto- mation engineer	3/4	4 Site visits Living Lab – observation
9	Campus management	6	One meeting - observed discussion
10	Carpenters, build- ing physicist from NTNU, represen- tative from window factory, resident	9	Window maintenance – observed discussion over one day

Table 2: Overview of data collection in ZEB Living Lab

<sup>13</sup> The first 15 pupils involved in the project began their apprenticeships in 2013.



The analysis process has been anthropological taking the empirical data as starting point for the analysis. However, following principles of 'abductive reasoning', both field data and existing theory were allowed to influence the researchers in the analysis process (Reichertz 2007<sup>14</sup>). Therefore, instead of forcing either the theory or the data into a framework, the researchers left space for their own logical reasoning (ibid.). We assessed interview transcripts, notes, reports and papers associated with the two projects and considered the response of craftspeople in terms of the impact the building regulations have on the craftspeople when putting his or

her skills into practice. In addition, we have reviewed the building regulations themselves, looking at requirements and changes that they imply. In the following section, the starting point is *where* and *when* skill meets building regulations during the construction of the two houses. The analysis emphasises the description by the craftspeople of their experiences with the process and their reflections over the changes implied by the building regulations. This enables an analysis that considers how it has been possible to bend the materials and tasks to the purpose when meeting the technical and functional challenges implied by the building regulations.

## Upscaling material use, and existing cultural resources

The following analysis is based on an interest in the impact of the building regulations on craftspeople working with two different 'super-insulated' construction cases in Norway. We start by presenting the more bottom-up Åfjord case, and then proceed with the more top-down ZEB Living Lab case.

### The bottom-up educational perspective in Åfjord

The Passive House standard implies new knowledge and potentially a new set of skills. The course in Åfjord took place in 2012-13 before the building regulation including Passive Houses became standard and at a time when the Passive Houses were a new phenomenon in Norway<sup>14</sup>. Teaching staff from Åfjord High School believed that by participating in the course, pupils studying carpentry would end up with a better understanding of the skills associated with building Passive Houses and be better prepared to meet the requirements of the building trade when they left school. However, it was initially unclear whether demands in the new building regulations required a new set of skills, or an adjustment of an existing set of skills. Jan, a teacher from Åfjord explained that learning about Passive House standards and building regulations was not about going through the texts approved by the state, but applying what is required in practice, taking drawings made by an architect and making them a reality through the application of their skill:

When we are building, we work with drawings pre-developed according to the requirements. We don't always need to think about the building regulations. They provide the background. It is similar when we teach. We focus on insulation requirements and U-values, but we do this without having the building regulations in front of us. They are not described directly in textbooks either, but the text is based on the building regulations.

Interpretation of the regulations happens through use, by putting them into practice. This requires a set of skills and it requires experience. This was something the pupils were in the process of acquiring. Martin, one of the two pupils interviewed, said that he had never built a house before, and that he did not know why

Passive House had become the new standard. When asked if the house would be a good house to live in, Kristin one of the two pupils interviewed replied:

We are receiving help through the whole training process, so I hope that it will be good. It is the first time that we have built a Passive House, so you have to bear that in mind. It will be very nice, but a bit different with its sloping roof. It will be more modern than a normal house.

With so much that was new and different the pupils could have lost sight of what was general carpentry and what was Passive House construction. This was however not the case for the two pupils that were interviewed. When asked whether he thought he would become a better craftspeople, Martin said that:

There is more material to work with, more learning in sawing and hammering. A bit more has to be re-done, although not as much as we expected. We have to go over things, double-check the quality and so on...

Martin understood the building process in a Passive House terms of thicker walls, which he saw as requiring more materials, and the demand for airtightness. When asked if the house would be a good house to live in Martin said, "I wonder what the air will be like on the inside because the house has to be so airtight."

A Passive House has to be approved before it may be called a Passive House; to achieve this label, airtightness is tested. Leakages in the building envelope affect airtightness, and this required extra care from pupils. Kristin, when responding to the same question on craftsmanship, had a similar focus on airtightness: "We are perhaps becoming more careful? We have to be more careful with the airtightness."

Even small mistakes meant pupils had to go back and re-do work they thought that they were finished with. Jan, the teacher from Åfjord also emphasises the need for care because of demands for airtightness:

<sup>14</sup> The Norwegian Passive house became established as its own standard in 2013. See NS 3700 <https://www.standard.no/nyheter/nyhetsarkiv/bygg-anlegg-og-eiendom/2013/ns-3700-kriterier-for-passivhus-og-lavenergihus---boligbygninger/>



We had to be more exact. It made us more aware of quality and finish. The pupils were aware of this, and it had implications for our work (carpentry) in general. There were a number of representatives from the construction industry present during presentations (Passive House course) and they asked critical questions about the standard, this heightened the pupil's awareness of the need to be careful and follow up details.

These critical representatives from the industry were also potential colleagues and employers, and their comments made pupils conscious of expectations regarding their skills after they left school. However, Jan also told us that the focus on airtightness was not new: "There was already competition within the industry, about building as airtight as possible. At least among serious actors."

The building regulations and Passive House standard meant that airtightness was expected in all buildings and being worked on by the whole of the industry, not just by a few "serious" actors. This implies a greater focus on the application of skill and the quality of the resulting buildings. An idea supported by the project manager for a building site in Trondheim, where 300 passive-houses were under construction at the time of the Åfjord project. Pupils visited the site as part of their course work. The project manager for the site suggested that the precision and care required to achieve the air-tightness associated with Passive Houses has resulted in a greater level of skill and professional pride, and in the building of houses of a much better quality (Woods et al. 2013a:8<sup>[9]</sup>).

In Åfjord we spoke mostly to pupils and teachers, and learning new things, developing skills is what carpentry studies at high school level in Norway is about. Achieving the required airtightness was an issue everyone agreed was a challenge, but a solvable one. Cost was never the main issue in Åfjord. The building project was about providing pupils with a practice-based course in Passive House building. The local construction industry sponsored the project and using pupils to build helped to lower construction costs (Woods et al. 2013b:13;36<sup>[9]</sup>). A year and a half later in the context of ZEB Living Lab the response to the same qualities was different.

### The top-down perspective of ZEB Living Lab

ZEB Living Lab represents what is expected to be the next stage in building standards in Norway. Living Lab is a pilot building and a laboratory, and is therefore technically complex, leading to several discussions about how to make it work according to specifications. A zero-emission house built for the Norwegian housing market is not expected to include so many systems or to be as complex. For example, Living Lab has three different heating systems, including a solar collector, a ventilation system with an electric coil capable of heating air up to 40°C and a ground source heat pump. Emil, an automation engineer who programmed the technical system in Living Lab, emphasised the complexity of the

process and the necessity for teamwork. Emil's programming was at the centre of the network of craftspeople, they depended on him to define where their work was to be done. Thus, the speed of his work affected when the rest of the team could do theirs.

Emil was not used to working on houses or with the level of systemic detail required. He described the process of working on ZEB Living Lab as very complicated, with things often being unclear. Emil and the other craftspeople working in Living Lab developed solutions as they worked: "A lot of things were new and the plan changed over time", and this made the process "very time consuming", taking a lot longer to build than expected. Particularly the electricians depended on Emil's work:

It has happened that I have made a mistake, 'miscalculated', but the electrician often has tips and suggestions about possible solutions. So, then we just have to agree on what.

Emil stated that he was not the only one struggling to solve problems:

I know that that the plumber has been scratching his head. Normally the heat pump and the ventilation system live their own lives. Now they are controlled together. We are testing different methods and trying to get things to work together.

Emil was not alone in thinking that the process of building ZEB Living Lab was new and demanding, the whole group involved made similar comments. The teamwork that resulted from this process suggests a complex process, one that demanded creative solutions from the craftspeople. A carpenter who worked on Living Lab, known here as Petter told us:

Disagree or agree, we are better off talking together to find a solution than disagreeing. It is about agreeing on a solution and along with the architect finding the best solution, one which is favourable and which works when put into practice. That is maybe the biggest challenge.

In other words, skill is important to craftspeople, but communication of that skill and making sure it is used correctly is also important.

New knowledge and skills can arise through the new fields and new players can be expected to be included in the future construction of buildings, for example the programming provided by Emil and solar energy production. Ola was the manager of a small company that supplied and installed the photovoltaic systems. The use of photovoltaics on buildings is not new, but installing it on houses is relatively new in Norway and so is its integration with the different systems installed in Living Lab. The house's complexity meant there was limited space for the equipment needed to run the different systems. Ola told us:



There was a lot of pipes, cables and equipment in that little room (the technical room), basically too much. We were originally supposed to put our inverters in there, but they were placed outside.

The complexity of the systems, the timing between the different team players (there were often delays in the construction of Living Lab) and the space needed for the different systems, caused conflicts between fields. According to Ola, the complexity of the building and lack of communication between team members challenged the ZEB concept:

All the different fields should have talked together. This is a building integrated system, which isn't actually so integrated and which has more layers than is really necessary. So, more materials have been used than necessary, to get it screwed into place. For the strictest ZEB standard, this would have been a negative thing.

ZEB Living Lab is a building where expectations about energy efficiency and sustainability are high. Existing skills and knowledge provide a foundation to deal with new standards and solutions. The new team players, represented here by the automation and solar engineers, found the process of integrating with other crafts challenging. The carpenter spoken to in this project was not threatened by changes taking place in the building industry. However, the carpenter and some of the engineers involved did express concerns about economic viability. Petter, the carpenter told us,

It is an advantage that the building is good for the climate, but I think about the customers and the population regarding prices. It might get too expensive for them. This is my job, so if I build a Plus House or a Passive House it is all the same to me, but perhaps this type of solution is more suitable for large buildings that actually use more energy.

This concern can be translated as a somewhat sceptical or critical perception of the project, and implies a rather cautious estimation about the future importance of this type of building. It may also be associated with the conservatism mentioned in the beginning of this paper, which is partially based on a scepticism to anything that increases construction costs, particularly if the company involved is not earning anything from the increase in costs (Rygghaug and Sørensen, 2009:986<sup>[9]</sup>, Risholt and Berker 2013:1027-28<sup>[10]</sup>). Pilot projects are about testing new solutions, ones that are not widely used on the market; this may cause an increase in costs. An increase in ZEB Living Lab that may have caused Petter's scepticism. Pilot projects may therefore not always result in positive dissemination.

The skills provided by the carpenter in ZEB Living Lab represent existing resource, a background of knowledge about the use of

carpentry during the construction of buildings. Petter told us:

It's my job, whether I am building a plus house or a Passive House, it's all the same. The difference is the number of different things and tightness. So, for me it doesn't make a difference what I build.

The skills are the same, and he is still building a house, but as mentioned earlier in the context of the Passive House in Åfjord, there are more materials to deal with and a greater focus on detail. Petter had worked on low-energy houses and Passive Houses, the concept of thicker walls and the focus on air-tightness in ZEB Living Lab were not new:

The assembly is the same, but the volume is perhaps greater. Instead of one packet of insulation we are using two. And then there is a new type of vapour barrier that I have never used before, which also is supposed to equal five centimeters of insulation. It is not much more complicated to build it, but you need more time, especially with this new vapour barrier where all the joints need to be taped.

Building highly insulated houses has become part of the existing knowledge associated with established skills. Petter understood constructing airtight houses as the use of existing skills rather than something extra and it was not a big challenge.

Petter emphasised that "we still need to solve things in a good way, so that they work". Zero emission houses, like ZEB Living Lab, also need to be functional offering a meaningful context for social relations. Outside the context of ZEB Living Lab, craftspeople believe that homeowners are not ready for the solutions available. In addition, there is no cost incentive for craftspeople to encourage homeowners to install more energy efficient solutions, because he earns no more from installing these solutions (Risholt and Berker 2013:1027<sup>[11]</sup>). In Living Lab, the end-user was not the homeowner, but the project leadership in the ZEB Centre, who had extensive knowledge about the available solutions and was not as dependent on economic considerations as a homeowner would have been. This competent end-user meant that there were tough negotiations between the different parties when choosing and planning solutions. Pilot buildings provide inspiration and examples about how to do things, but in the case of ZEB it also implied higher costs and greater complexity.

The description by the team of electricians working on Living Lab suggests a link between existing and new skills. They worked closely with different kinds of craftspeople and their established knowledge and skills were useful when working with both the previous and new building regulations. Espen gave us an example, when answering our question about whether working on the house had been an interesting learning process:



It is a little bit of both: you get some new knowledge about what the solar engineer does. But what I am doing is laying wires and cables for him. I'm still laying cables, but you do sort of pick up bits of information.

When asked if there was anything new or difficult involved in the construction of ZEB Living Lab, they said several times that there was not much that was.

The main challenge was the amount of equipment that went into the house and the time the house took to complete. In such a complex building, good designs and timing were essential. That the design process now includes new tools producing 3D digital models was looked upon by the team as positive, as long as their knowledge and experience is also included. Ove, one of the electricians provided insight into the process:

what was traditional before was models and drawings just being seen from the top down. Where they look very good before you notice that they collide massively with other stuff.

With the new 3D drawing tools, it is possible to "run a crash test, they just press a button and 'Bang!', up pops a mark where it collides."

The building process is a continuously shifting perspective based on tradition and innovation (Gell 1998:256<sup>[9]</sup>). Each new house points the way towards houses that are yet unbuilt. The electricians' insights show how new skills and technical changes are filtered through existing resources in the form of pre-existing skills and knowledge. This allows solutions for sustainable requirements to be developed, but it can also provide barriers, because what is built is often the best possible compromise in the light of all the practical difficulties and constraints that are met (ibid.: 257).

## Discussion and conclusions

The Åfjord case and ZEB Living Lab represent two different stages in the building regulations; they also offer insight into the response by two different generations of craftspeople to what the changes introduced by the building regulations imply. In Åfjord, we met a group of pupils and their teachers. The whole process of building the house was about the learning new skills, both general carpentry skills and Passive House knowledge and skills. The example highlights the social process of skill transfer from experienced craftspeople to the high school pupils, at the same time as it offers an interpretation of the skills rather than rigid transfer (Ingold 2009:92<sup>[9]</sup>). The pupils were at the start of their careers in the construction industry and as such not hampered by experience. Craftspeople in ZEB Living Lab were experienced within their fields, challenges were all solvable, but they saw the construction process not just in terms of the application of their skills, but also within a wider context of their experience in the construction industry and when dealing with customers. From this perspective, an increase in costs cannot be solved as easily as a reuse or readjustment of skill and time is money.

In this paper, we have considered the negotiations between the meaning, value and skill when a craftspeople deals with a set of new or forthcoming building regulations. In the context of the Passive House and the zero emission building (ZEB), we saw no sign of a reduction in dedication, due to the demands set by changes in building regulations, nor did we see a reduction in the need for skill when carrying out the construction work. Craftspeople within the construction industry continue to apply their craft and to produce good work (Sennett 2008:20<sup>[9]</sup>). Even when faced with changes in building regulations. The regulations require buildings to be energy efficient, material intensive, airtight, highly technical wooden houses does require craftspeople to review their skills, but the craftspeople in this study do not see themselves as needing new

skills. They had reconsidered their skills and found them capable of dealing with the changes, but at the same time, they discovered a need for more care and control when applying those skills. Energy and material efficient buildings allow no room for cutting corners, airtightness is tested and approved and leakages mean redoing things and a potential increase in costs.

Building regulations represent a frame of meaning with which to control the construction industry: the intention is to elicit buildings that use less energy, are more material efficient and capable of dealing with the milder, wetter climate that Norway is increasingly experiencing. This paper shows that requirements are not necessarily difficult when it comes to applying skill. Rather, difficulties arise when new or previously unfamiliar groups of craftspeople have to work together on rather complex technologies not yet tested, and where time, cost and vested interest in creating 'dazzling' demonstration projects frame the construction process. The small actors or individual craftspeople have been in focus, how they deal with the overreaching system of the building regulations and remain future oriented (Gell 1998:256<sup>[9]</sup>). These small actors although future oriented in how they offer solutions to practice based problems also represented a conservative voice within the construction industry; an industry not known for being receptive to change (Stortingsmelding om bygningspolitikk, 2012<sup>[9]</sup>). The two pilots had two different aims; the Åfjord project was practice-based. Craftspeople learnt about the Passive House standard through the building process, the project was based on their needs. ZEB Living Lab, on the other hand, intended mainly to 'dazzle', and craftspeople did not feel fully engaged with the development of a high-tech and potentially expensive building. In ZEB Living Lab, the application and adaptation of craftspeople's skills was not experienced as a major challenge, but rather complications occurred due to a high-tech pilot ambition that required time, coordination and was understood as cost intensive.





Developing pilot buildings in collaboration with the industry is a way to deal with some challenges, real-life examples that show the way, demystifying and presenting impressive craftsmanship. However, the complexity of the ZEB Living Lab appears to be counterproductive: craftspeople remain sceptical to the zero emission reality that it proposes, doubting that such a complex house could actually become a widespread solution for the general public. In addition, the building costs remain a barrier. We therefore conclude that pilot buildings should show the way forward, and at the same time avoid focus on building complexity and costs. The Åfjord project became a model for other practice-based construction projects for high schools in Central Norway and closing the gap between research, demonstration and practice suggests a way to go (van Bueren and De Jong 2007:554<sup>19</sup>). Hands-on experience based on traditional building skills continues to have value in the

construction industry and this can play a role in bridging the gap between conservatism and reinterpretation of crafts.

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# CRAFTSMANSHIP IN THE MACHINE

*Sustainability through new roles in building craft at the technologized building site*

by Håkon Fyhn & Roger Andre Søråa

*The building industry is becoming increasingly characterized by automated production, and in line with this, the nature of craftsmanship is transforming. In this article, we look for a sustainable path for this transformation through a case study that follows a team of carpenters building a set of tower blocks at a high-tech building site using “lean” construction techniques and robotic production technology. The builders are organized according to complex schedules of lean construction, making work at the building site resemble that of a large machine. The builders hold multiple roles within this machine: more than simply “living mechanisms” inside the machine, they also take on more parental roles as “machinists,” employing their crafting skills in planning, problem solving, improvising, coordinating and fettling in order to make the building machine run smoothly and to minimize environmental uncertainty. The craftsmanship in action is characterized by what we call workmanship of uncertainty – the ability to produce certain results in uncertain conditions. We identify this as the collective skill of a community of practice. The sustainability of craftsmanship in the machine is analyzed according to three kinds of sustainability: cultural, social and ecological. We suggest that all three forms depend on the building company’s ability to provide working conditions that allow the builders to form stable communities of practice in order to perform, share and develop craftsmanship. Finally, we show that working in and with technological production systems does not require fewer skills (of craftsmanship) than traditional building, but a nuanced application of these skills.*

**Keywords:** *craft; work automation; community of practice; lean construction; workmanship of risk*

**Authors:** **Håkon Fyhn**  
*PhD. and Senior Scientist*  
Center for Technology and Society, KULT, NTNU, Trondheim, NORWAY  
**Roger Andre Søråa**  
*Research associate*  
Center for Technology and Society, NTNU, Trondheim, NORWAY

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## Introduction

What will be the nature of craftsmanship in the building industry of the future? In this article, we explore this question by observing the building crafts in action at a modern, high-tech building site. At the site, builders and machines work together in a complex production system designed to raise five tower blocks. The towers are made from wooden elements that are produced by robots at a factory and built through a “lean construction” system on site in Trondheim, Norway. Lean construction implies a tightly coordinated building process wherein the builders contribute to planning and improving the process (Koskela et al. 2002<sup>[1]</sup>). In this study, we follow a community of carpenters through the entire building process, focusing on the transformation in their craftsmanship as the building process becomes increasingly technological, and exploring their work as a community of practitioners. We investigate the particular skills that enable this community of workers to transform plans and designs into reality in the form of five tower blocks.

In any investigation of the future of craftsmanship, sustainability is an issue. Analyzing the direction of a certain development leads one to question whether this development forms a trajectory that is able to sustain itself, including the society and environment it is part of, both now and in the future. For building crafts, three kinds of sustainability seem particularly relevant: cultural, social and environmental sustainability. (A fourth kind of sustainability, *economical sustainability*, is not addressed in this paper). *Cultural sustainability* is addressed through an analysis of the preservation and development of traditional building crafts and craft cultures in the technologized building industry. *Social sustainability* is investigated through an analysis of the transformations in the building industry that have made it increasingly difficult for builders to sustain a decent life. Finally, environmental sustainability is addressed through an analysis of the building industry's increasingly important role in the transition to a sustainable low-carbon society (European Commission 2011<sup>[2]</sup>). While environmental sustainability is not the main focus of the present study, the case indicates that the building industry's ability to contribute to environmental sustainability depends, in large part, on the former two kinds of sustainability.

In the following, we give a brief account of the technological and social transformations occurring in the building industry, before presenting our methods and the case study analyzed in this paper. We then introduce a theoretical framework for craftsmanship and technologization, before describing the role of crafts in the “machinery of building” and discussing this role as it relates to sustainability.

### Technological Unemployment, Deskilling and Reskilling

For a long time, the Norwegian building industry has been seen as rather conservative (Ryghaug and Sørensen 2009<sup>[3]</sup>); but during the last couple of decades, many changes have occurred in the industry, taking it in the direction of automatized production.

We identify this tendency through the adoption of two kinds of technologies: First, automation technology, such as robots that perform tasks such as drilling, painting and laying bricks (tasks previously done only by humans). Such technology also includes the more radical development of large 3D printers that are able to print complete houses<sup>1</sup>. The increased use of prefabrication is also part of this development, wherein elements are produced in a factory for later assembly on the building site. Prefabricated houses have been produced in Norway for more than a hundred years, but the scale of such production has escalated during the past decade, with the added element of customisation. As a result, prefabrication now plays a role at almost every building site. The second new technology comprises advanced production techniques, such as lean construction (Koskela et al. 2002<sup>[4]</sup>), which make the on-site building process subject to the same kind of technological management as factory production. Such technologization gives the entire building process a machine-like quality. While technologization of the building site is the main focus of the present paper, we see it in close relation to automated production.

A narrative that is often used to frame automation in relation to craftsmanship is that of machines taking jobs from humans: rather than serving as a tool for a bricklayer, the bricklaying robot may replace the human worker altogether. Although, historically speaking, automation has produced a variety of new jobs for humans (who must subsequently construct and operate the machines), the fear of “technological unemployment,” as Keynes described it in the 1930s (Susskind and Susskind 2015:284<sup>[5]</sup>), has gained renewed interest in recent years. This is particularly true in relation to the so-called “Industry 4.0,” wherein industrial robots are able to perform rather customized forms of production that were previously restricted to humans (Schwab 2016<sup>[6]</sup>). The situation has inspired many public reports estimating the number of jobs that will be lost to machines within the next couple of decades. The reports indicate that a significant proportion of contemporary jobs will disappear in countries such as the USA (Frey and Osborne 2013<sup>[7]</sup>), Sweden (Hultman 2014<sup>[8]</sup>) and Norway (Pajarinen et al. 2015<sup>[9]</sup>). These reports tend to be particularly pessimistic with respect to the fate of skilled workers in the building industry. For instance, a Norwegian report estimates that eighty-two percent of bricklayers will be redundant within twenty years, along with eighty-one percent of painters, eighty percent of building construction workers and seventy-two percent of carpenters.

However, when discussing the issue with builders, we found that they did not seem very concerned about being replaced by machines. “No, the building process is too unpredictable, you will always need human workers,” a crew leader said, rather confidently. It was another aspect of this development that seemed to concern the builders – not the loss of work, but the loss of craftsmanship. This was particularly voiced in relation to prefabrication technology.

<sup>1</sup> <https://www.sciencealert.com/the-world-s-largest-3d-printer-can-now-make-entire-houses-out-of-clay>



Although the production of prefabricated elements required much of the same work as on-site building, it was not always seen as proper craftsmanship: "You are not a craftsman, you are a factory worker," an old master mason told us. "Being able to work outside, in rain, snow, and sunshine is part of real craftsmanship," he argued. A more precarious threat to building craft seemed to face the builders who worked out in the snow and rain, assembling the prefabricated elements: the risk of deskilling, or losing the ability to build houses from scratch. A young carpenter who worked with prefabrication commented: "With this, you are not a craftsman; you are an assembly worker." *Deskilling* implies a loss of status and identity (Fyhn forthcoming<sup>[9]</sup>), but as our study indicates, there might also be an element of reskilling (acquiring new skills) that deserves inclusion in the narrative of technologization and craftsmanship.

### The Nordic Model of Work

The craft skills in question exist in a cultural context: Norwegian builders tend to regard themselves as craftspersons and they distance themselves from unskilled workers, industry workers and assembly workers (Fyhn forthcoming<sup>[9]</sup>). This status reflects the training system in Norway, which is a standardized version of the traditional training system for the crafts: one to two years of vocational school followed by two years of apprenticeship before the journeyman test, which initiates builders into the ranks of journeymen. This educational structure is the same for carpenters, bricklayers, plumbers and electricians, as well as goldsmiths, potters and other manual craftspersons.

The status of craftsperson in the Norwegian building industry is also affected by what is commonly called "the Nordic model of work" (Gustavsen 2011<sup>[9]</sup>). See our figure below:

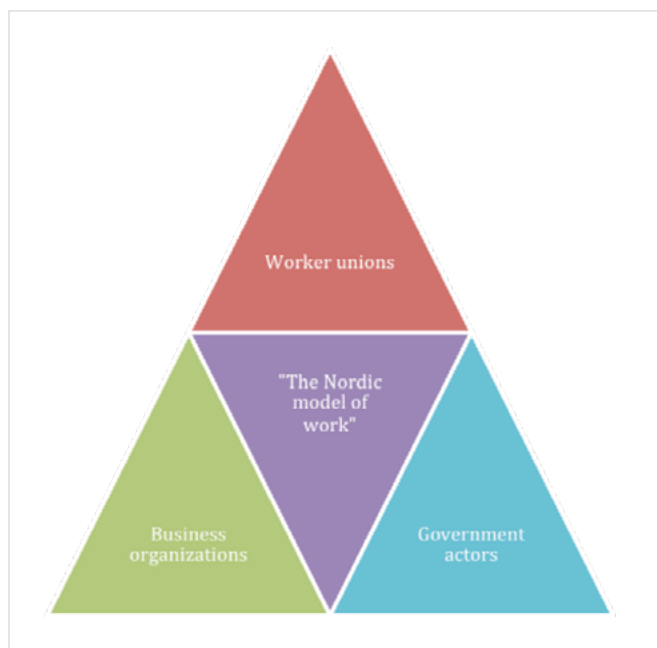


Figure 1: The Nordic model of work

The hallmark of the Nordic model is an organized relationship between worker unions, organizations (representing business leaders) and government. This three-part collaboration is responsible for ordered and relatively fair negotiations about workers' conditions and serves to give workers a voice. As a result, builders expect to have a say in how things should be run at the building site, and they are prepared to take responsibility for solving any problems that occur. Taken together, the Nordic model and the Norwegian emphasis on formal skills seem to empower builders in Norway (see Tesfaye 2013<sup>[9]</sup>).

Over the past ten to fifteen years, working conditions in the building industry have changed, due to new business models and the internationalization of the labour market. Building companies are shifting from their previous reliance on permanently employed builders to relying on casual workers, who they employ from job to job – a business model associated with "social dumping" (Alber and Standing 2000<sup>[9]</sup>; Bals 2017<sup>[9]</sup>). Today, the number of casual workers employed through vacancy agencies is far greater than the number of permanently employed builders at major building companies (Marsdal 2015<sup>[9]</sup>). The typical building company is no longer a community of builders and office workers, but only office staff – those who plan projects and produce tenders; the focus of such companies seems more oriented towards economic speculation, while the actual building work is outsourced (Røyrvik 2011<sup>[9]</sup>). Builders on temporary contracts provide the office flexibility in the event that the company does not win a contract. But it is the builders who pay for this flexibility, as they are forced to live in uncertainty and form what Standing (2011<sup>[9]</sup>) calls a "precariat." This development is dreaded by builders in Norway, who wait for the day on which *their* company will sack its permanent builders and rely on vacancy agencies for staffing. Having to work for vacancy agencies and line up for jobs with the "casuals" is described by the builders as a "worst nightmare" (Fyhn forthcoming). In many cases, working conditions on job sites are illegal, but this is difficult to prove, as workers hired by a subcontractor may have been hired by another subcontractor, which again may have used a third subcontractor (etc.), comprising a network that is designed to be difficult for authorities and unions to track (Bals 2017<sup>[9]</sup>). As a result, the Nordic model is irrelevant at many building sites, and achieving the necessary conditions for social sustainability proves difficult.

Cultural sustainability is also threatened when building sites and companies no longer exhibit stable communities of practice. We were told that it takes several years of training following the apprentice period to become a skilled carpenter. This learning becomes difficult when there is no community to learn from. The quality of the work is said to drop without a stable community of practice. "The casuals come in for a few days to do a job, they make lots of building errors and then they leave without even knowing they made them," a frustrated builder told us. He continued, "at the next building site they make the same mistakes over again, happily unaware." According to some builders, such errors have consequences for environmental sustainability, as houses may not perform as well as they should in terms of energy efficiency.





From the builders' perspective, it seems that the tendency to rely on casual workers does not enhance sustainability. Despite this, it has proven difficult for companies relying on permanently employed builders to compete with companies using outsourced workers, due to higher personnel costs. However, some companies still seem able to compete. The company responsible for the building at Moholt (the site examined in this case) is an example: rather than sacking its skilled builders, it employed more. Relying on relatively expensive yet permanently employed builders, the company engaged in a stable community of practice. Its argument was that this community would be able to build more effectively and with fewer errors than would temporary workers at other companies. An essential aspect of this approach was involving builders in the planning process and applying lean construction principles. But this system also implied challenges in terms of redefining the traditional role of craftsmen. What is the new role of craftsmanship in the building industry? Does it point to a way forward for craftsmanship that is sustainable in any of the three ways we have suggested? We approach this question through a case study of the Moholt site.

#### Studying Craft at the Building Site Moholt 50-50

This study is based on fieldwork at a building site at which the company Veidekke built five tower blocks for student housing for the local university. The tower blocks stood nine storeys high. They were energy efficient, fulfilling the passive house level, and were made entirely of massive wood – except for the basement and ground floors, which were made of concrete in order to “anchor” the light towers. While concrete production produces substantial CO<sub>2</sub> emissions, massive wood binds with CO<sub>2</sub> in the air, reducing carbon emissions by fifty-five to sixty percent.

The tower blocks' wood construction made the building site special. While concrete-based building sites tend to be wet, drafty and noisy from constant drilling, this site was dry and quiet. There was no need to drill holes as screws could be inserted directly into the wood. Also, the site had a distinct smell of pine, rather than wet concrete. “This warms the heart of a carpenter,” one of the crew leaders said on one of the first days of the fieldwork, reminding us that the craftsman identity also has an aesthetic side.

The fieldwork was conducted by the first author in concentrated periods throughout the entire building process, during which the

same community of carpenters was followed. These carpenters called themselves *snekker*, in Norwegian. In English, we would use the term “carpenter,” but in other contexts the term may also be translated as “builder” or “construction worker” (even though a *snekker* is always considered a craftsman). The fieldwork started in February 2016, when the building site was covered in snow. At that time, the first storeys had been built atop the concrete basements. The next period of fieldwork was in March and April, during which most towers were erected to their full height. The fieldwork continued in June, which saw much work done on both the inside and the outside of the fully erected towers. In June, the weather was nice and the builders wore short working trousers in signal colours, in addition to their obligatory safety shoes, helmets and protection glasses. At this time, the builders clearly longed for the summer holiday, but they had to work hard as the first three towers were scheduled to be finished at the end of the summer. The final period of fieldwork was in November 2016, after students had moved into the first three towers and as the final two were being prepared for the final inspection before being handed over to the client.

The fieldwork involved participation in many planning meetings, daily conversations with people and observations at the site. Much of the fieldwork focused on understanding what the builders did and said, attempting to learn their vocabulary and the principles by which they worked. In particular, the fieldwork involved significant contact with the crew leaders on site (called *bas* in Norwegian) and the foremen at the office (*formann* in Norwegian), who were all extremely helpful in making the process of building a tower block understandable for us anthropologists. In addition to participating and observing, we also conducted eight formal interviews with people involved in the building process: one with the client, two with engineers and five with carpenters.

The fieldwork was framed by a larger study of craftsmen and apprentices in the Norwegian building industry: “Crafting Climate Transitions from Below.” This research project seeks to understand the role of craftsmen in the transition to more climate friendly building practices. The project includes studies of discourses of craftsmanship tools and policy, in addition to analyses of interviews with craftsmen, conducted by all authors between 2013 and 2017.

## Understanding Craftsmanship in a Technologized Context

Craftsmanship at a high-tech building site such as Moholt must be seen in relation to the technology it works with. This implies automation and technological production systems such as *lean* construction. While craftsmanship, in its simplest definition, refers to “skills in a particular craft” (*Oxford English Dictionary*), craftsmanship in a technological context requires more specificity. The craftsman and philosopher David Pye offers some direction in his work *The Nature and Art of Workmanship* (1968<sup>[9]</sup>). Pye prefers the slightly more modest

term “workmanship” over “craftsmanship,” commenting that it is not possible to say where one ends and the other begins (*ibid.*: 20). In his work, Pye concludes that it is futile to separate between work done by hand and work done with machinery (*ibid.*: 25). For example, a dentist drilling a tooth with an electric drill is more reliant upon his steady hand than a carpenter using a hand-driven wheelbase to drill a straight hole in a piece of wood. Rather, Pye suggests that the degree of risk at play serves as a better way to distinguish



workmanship from machine production. While the dentist drills with great risk of failure, the carpenter operating the wheelbase hardly exercises any risk at all, unless he/she is fool enough to break the drill. Pye thus introduces the term *workmanship of risk*, in contrast to *workmanship of certainty*. An example of workmanship of risk is sawing and scarfing boards to build a cabinet by hand. When using a planer and other tools, a workman still relies on his judgment, dexterity and skill to achieve the desired result. The workman needs to be alert and present in the work as the result is *continually at risk* through the whole process of making. This presence implies being more or less “immersed with his whole being in a sensuous engagement with the material,” as Ingold (2000:295<sup>[6]</sup>) puts it (even though the degree to which his “whole being” is immersed, in practice, seems to vary).

If, on the other hand, the pieces of cabinet are routed by machines at a factory, the result follows from the set-up of the machines and does not depend on the judgement, dexterity and skill of the workman. As such, workmanship of certainty is in effect when the workman is operating the machine. Let us not forget that workmanship of certainty is also workmanship, and implies the worker’s skill and presence. Such workmanship is different from a traditional understanding of workmanship, but may become more important as machines and machine systems become more complex. In practice, building work at a contemporary building site implies both forms of workmanship and, as we suggest, also a third form.

While workmanship of risk has traditionally played an essential role in house building, the introduction of prefabrication and automation has moved more of the work into the sphere of workmanship of certainty. Still, workmanship of risk plays a role. At a modern building site it can apply to more than scarfing boards, fittings and joinings. As the following case study indicates, unforeseen things tend to happen at building sites, introducing an element of uncertainty to even the simplest tasks. This calls for a form of workmanship we might call *workmanship of uncertainty*, rather than of *workmanship of risk*. The word “risk” points to the risk of loss, as the desired result is at stake at every moment of the work. The word “uncertainty,” on the other hand, points to a condition of not knowing what lies ahead (Whyte 2009<sup>[6]</sup>). While Pye’s workmanship of risk implies a reliance on judgement, dexterity and skill to produce a certain result under the constant risk of error, workmanship of uncertainty implies the production of certain results under uncertain conditions. Risk is always present, as the result is at stake throughout the entire process, but the risk of messing it up is also connected to not knowing exactly what is ahead, and this risk seems to increase as the building process becomes more complex. In this respect, even the task of assembling prefabricated elements implies a risk that calls for skill and judgement.

The ability of craftsmanship to produce a certain result under uncertain conditions also implies an element of *improvisation*. While improvisation in this setting means dealing spontaneously with situations that arise, it does not mean being unprepared. On the contrary, improvisation in the building process is something builders

should be well prepared for. When a carpenter sets out to build a house, he/she cannot know all the challenges that will occur further down the track, but he/she will have already built so many houses that he/she will have a certain idea of what to expect, and will trust that he/she will make the right decisions along the way, even if he/she cannot foresee all these decisions. The carpenter’s skills, experience and preparation become *improvisation potential* (Jørgensen 2004<sup>[6]</sup>) – the potential to make the right decisions and perform the right actions at the right times during an unpredictable process. Improvisation along the way, involving finding solutions to problems as/when they occur, makes it possible to produce even and predictable results from uneven and unpredictable situations. This is workmanship of uncertainty.

Workmanship of uncertainty also implies planning – not necessarily planning in terms of articulating the finished state of the building (as in an architect’s drawing), but planning in terms of looking ahead, beyond the next step, to find a sustainable way forward – planning in terms of discerning the way, rather than articulating the result, as distinguished by Ingold (2013:109–11<sup>[6]</sup>). The ability to plan is part of improvisation, as it is part of any craft. At a large building site, the ability to plan stands out as even more essential than it might otherwise be for a craftsman working alone.

Building a house is rarely a solitary activity; rather, it typically involves teamwork. In the present case, more than 50 builders were engaged in work at the building site. The community of builders solved problems, improvised and produced steady results, because they worked in uncertainty. Their ability to succeed depended on their ability to collaborate, learn, plan and improvise as a community of practice (cf. Wenger 1998<sup>[6]</sup>). This required a certain level of organization.

The community of practice was also essential for managing the different skill levels between builders. Builders’ concerns with respect to their skills often relate to fears about becoming assembly workers, but losing a community of practice may be equally detrimental for their skill development. Building skills are learned and practiced (trained) through work at the building site. The apprentice learns through active participation: doing the practical work and making mistakes while being guided and corrected by senior builders on site. Also, after the apprentice period, training continues through engagement with actual work. It is the collective of builders that develops new builders – enabling them to observe and learn from more experienced members of the community – through the combined efforts of colleagues in the community of peer practitioners (Søraa et al. 2017<sup>[6]</sup>).

### Craftsmanship in the Era of Technologization

Understanding craftsmanship in technologized building projects calls us to inquire into the nature of the technological more closely. In particular, the aspect we might conceive as machine technology might be useful for the craft perspective. A machine is defined as “an assemblage of parts that transmit forces, motion, and energy one to another in a predetermined manner” (*Webster’s English Dictionary*). While a machine is often understood as one particular



solid entity, such as the engine of a car or a robot at a factory, it can also be understood more abstractly, as a principle. However, there is always design behind it: the dictionary points out that a machine is “a constructed thing whether material or immaterial.” The term can also be used more metaphorically to describe “a group of people who control and organize something,” as exemplified by “Churchill’s war machine” (*Oxford English Dictionary*). The technologization of the building site implies the introduction of machines as entities; but more importantly, it makes the more abstract principle relevant, as the building process is organized as an assemblage of parts and people that work together in a (more or less) predetermined manner.

One characteristic of the machine – be this an entity or a principle – is the *predetermined manner* in which it works and is expected to produce results. From the point of view of craftsmanship, this is what links the machine to workmanship of certainty. Ingold’s (2000:304–8<sup>[9]</sup>) deconstruction of the industrial production machine throws light on this: in the old manufacturing workshop, the craftsperson would guide the tool with his dexterous hands, in interaction with the material. With “machinofecture,” the tool is guided by the machine, as the edge of a carving knife or the spindle of a loom (the “working-point”) is mounted on a moving mechanism. As the movement of the working-point follows a set course – one that is fixed in advance by the machine’s design (cf. Ingold 2000:296–306<sup>[9]</sup>) – a particular kind of certainty is introduced to the work, even if errors might still occur. Further, the machine implies a particular instrumentality, which is separate from the experiencing human hand and sensibility (cf. Bruzina 1982:167<sup>[9]</sup>).

Ingold’s argument suggests an opposition between the craftsperson, who is “immersed” in sensuous engagement with the material, and the machine operator, “whose job is to set in motion an exterior system of productive forces, according to principles of mechanical functioning that are entirely different to particular human aptitudes and sensibilities” (Ingold 2000:295<sup>[9]</sup>). Still, he does not suggest a fundamental duality between the human operator and the machine, as the operator should be seen as part of the machine (transmitting force, motion and energy), in addition to the workpiece (following the argumentation put forward by Relaux in 1871<sup>[9]</sup>). As part of the machine system, the human operator can be said to be in a different relation with the machine; it is not the machine that is serving the human, but the human operator serving the machine system (as pointed out by Marx 1930:451<sup>[9]</sup>).

Marx describes a similar role for human workers in the pre-industrial manufacturing workshops, as “the living mechanisms of manufacture” (1930:356, 451<sup>[9]</sup>; Ingold 2000:309<sup>[9]</sup>). The idea of humans serving machines becomes more obvious as the manufacturing workshop is turned into a factory hall in which lines of machines form a single production system. The archetypical example is Ford’s plant at Highland Park, where a great number of machines were coordinated into a production line transforming raw steel bars into finished Model T cars. The production and transportation of steel into the

plant were coordinated as parts of the same machine system, along with the workers on the production line. This plant represented the start of what was a few years later called *mass production*.

Mass production is characterized by a great number of similar products being pushed forward along the production line. The focus is on large quantities, minimal costs and continuous operation of the production line. Work at each work station should be so simple that a worker can be trained for the task within minutes. Thus, workers are not only parts of the machine system, but *replaceable parts*, in stark contrast to the craftspersons of manufacturing workshops. The activities of mass production workers are limited to the monotonous and predetermined tasks of the workstation; they are not included in planning, nor do they make any other contribution to improving production. The slightly inhuman aspect of mass production work has been caricatured in movies such as *Modern Times* by Charlie Chaplin, forming a clear opposition to the rather romantic view of craftsmanship presented by Ingold.

Lean production replaced much mass production in the car industry during the 1990s, and is currently becoming integrated into other industries. Lean production systems tend to be coordinated in such a way that they align with understandings of a machine, as both an abstract principle and a metaphor. “The Toyota machine” is similar to “Churchill’s war machine,” as suggested in the title of the book that opened the world’s eyes to lean production: *The Machine that Changed the World* (Womack et al. 1990<sup>[9]</sup>). This book presents the principles that developed Toyota from almost nothing after WW2 to the largest car producer in the world. The Toyota production system has some different properties than mass market production systems, also when seen from the perspective of the workers.

Lean production is more than a production system; it is also a different way of thinking that requires penetration throughout the entire organisation in order to work. For workers, lean production implies a different role for worker groups, giving them more responsibility and multiple functions in the production process than what is otherwise offered to them in mass production systems (Melles 1997<sup>[9]</sup>). It moves from a “push system,” wherein products and components are pushed down an assembly line, to a “pull system,” wherein only the products and components that are asked for are delivered to each station. “Just in time” (JiT) delivery is an essential aspect of lean production and implies the tight involvement of external suppliers. This calls for a different relationship between producers and subproducers, wherein a strict contract relationship allows for a trust-based relationship founded on a sense of shared destiny. This sense of shared destiny is also said to characterize the relation between workers and the company at Toyota, as the workers are often employed for life.

With JiT there are no reservoirs of components piling up at workstations, as buffers. This implies the constant risk of stops in production if a component does not arrive in time, but such risk is actually said to make workers and producers more alert (as we saw in workmanship



of risk), contributing to fewer stops. The build-up of spare components that is so typical of mass production is, within lean, considered a form of waste (called *muda* in Japanese). Unnecessary use of space, time and movement are also forms of *muda*. Another essential term in lean is *kaizen*, referring to the philosophy of continuous improvement. In a lean production system, when a mistake is detected, the assembly line is stopped and the source of the problem is tracked down and removed. This process actively involves all workers and any worker is allowed to stop the production line; in mass production systems, only production leaders are entrusted with this task. *Kaizen* significantly reduced the time that Toyota's production lines stood still, as the causes of stopping were continuously removed. Another essential term in lean is *genchi genbutsu*, meaning something like "go to the right place and see." The idea here is that decisions should be made as close to the actual work as possible – normally in the production hall – and leaders should spend time there, rather than at the distant office. As variations of the lean production philosophy have been introduced at other car producers, the costs of production have significantly reduced. For example, Porsche was able to reduce its production costs per car by 53 percent by adopting lean production techniques (Khattak and Sharwar 2014<sup>[9]</sup>). However, while achieving high customer satisfaction, lean production has been criticised for not sufficiently considering worker satisfaction (Babson 1993<sup>[10]</sup>).

## Lean building at Moholt

The Moholt project followed a specific principle within lean construction called TAKT. TAKT was developed by Porsche Consulting<sup>2</sup> and adjusted to fit Norwegian work life. When the building work started, there was much excitement as to how the TAKT model would work. This was the third building project in which the company had used this principle. In their first attempt, they had not managed to maintain the required pace of work, but many essential lessons were learned from the problems that occurred (Andersen 2012<sup>[9]</sup>; Khattak and Sarwar 2014<sup>[9]</sup>). The second attempt was executed more smoothly, but was still not perfect (Mordal 2014<sup>[9]</sup>). By the time they were preparing for the third attempt, the workers had gathered so much experience that they hoped to hit the mark properly.

With TAKT, the entire building process was structured as a factory hall – an assembly line through which objects being built moved from work station to work station, where the necessary operations were conducted. At the building site, it was the workers who moved through the building, resembling a production line, while the building stood still. The moving teams of builders were called "wagons," as they moved through the building like wagons in a train. The wagons typically consisted of two to four builders performing specific operations. In total, twenty-three wagons moved through the tower blocks at Moholt, covering all operations, from putting up structuring walls to cleaning the finished rooms. Each wagon completed one storey of a single tower

Lean production principles were first introduced to the building industry under the description of *lean construction* (Koskela 1997<sup>[11]</sup>). In contrast to cars, which are produced in great numbers, building projects are typically bespoke projects. They are also more stationary and take more time to complete. For these reasons, lean philosophy had to be modified to suit industry needs. But the fundamental principles of lean remained: *kaizen*, constant learning; *muda*, elimination of waste; *JiT*, just in time delivery; and *genchi genbutsu*, worker involvement. In lean construction, worker involvement implies significant involvement in project planning, as every project needs to be planned in a more unique way than in car production. The *Last Planner System* is a systematic approach to construction planning that is commonly associated with lean construction, involving regular meetings with workers. At Moholt, a planning system called *Involved Planning* was developed to take advantage of the Nordic model of work and to involve the workers to an even greater extent than was otherwise possible through the Last Planner System (Andersen 2012<sup>[9]</sup>, 2017<sup>[11]</sup>). The practice at Moholt showed traces of Volvo's *Reflective Production* program, which was also developed within the Nordic model and emphasised workers' involvement in planning to ensure meaningful work situations (Ellegård 2007<sup>[12]</sup>). Similarly, over time, Toyota's production system became more worker-focused than the original customer-focused system that served as the model for lean (Pil and Fujimoto 2007<sup>[13]</sup>).

in one week, implying that the towers were built at the speed of one floor per week. When wagon one finished the first floor, it would move up to work on the second floor while wagon two would move onto the first floor. The week after, wagon one would move to the third floor, wagon two would move to the second floor and wagon three would start working on the first floor. In this way, the process progressed until all twenty-three wagons were engaged "in the train." Once the first wagon finished the top floor of the first tower, the "train" would move on to repeat the process in the next tower, until all five towers were complete. Every wagon used forty weeks to move through the entire building complex, with the last wagon starting and finishing twenty-three weeks after the first.

When the concrete foundation was in place, workers started to assemble the prefabricated elements that made up the outer and inner walls and served as a carrying structure for the towers. When the roof was tightened and the wood dried, work started inside the building. This preparation was conducted by the first wagon. The second wagon consisted of carpenters, who carried out the timber work on the floor. The third wagon installed plumbing, whilst the fourth installed the main ventilation. The fifth and sixth wagons installed electric gates and cables, respectively. The seventh installed insulation and plasterboard, and the eighth and ninth wagons put up the inner roofing. The tenth installed more ventilation and plumbing. The eleventh put up more roofing and

<sup>2</sup> <https://www.porsche-consulting.com/en/services/industry-expertise/construction/>.



inner cladding. The twelfth laid the floors, and the thirteenth wagon painted. New wagons with new tasks continued to move through the towers until the twenty-third and final wagon, which consisted of cleaners, prepared the building for handover to the client.

During this period, the builders found ways to be more effective and to build faster, according to the *kaizen* principle. As the speed of the train was fixed to one floor per week, increased efficiency was “cashed out” by gradually reducing the number of builders in each wagon. During the building time, we saw fewer and fewer builders in each wagon. Reducing the number of builders in different wagons was a common topic at weekly meetings. Builders removed from a particular wagon would be given other tasks on site or added to other wagons later in the train. When this process worked smoothly, it could radically improve building efficiency; but it was also quite vulnerable, as it depended on tight coordination. Delay in a single wagon could halt the train and stop the building.

Looking at the building from a distance, over time, we formed an impression of the building site as a gigantic machine, with a production line that moved systematically through the tower blocks, one floor per week, like an old steam train with the sound of carpentry. It was constantly fed stacks of plasterboards, pipes and other material. At regular intervals, the machine stopped and builders came out for their nine o'clock coffee breaks and lunch breaks, before they – and

thus the machine – moved on. In this way, the large machine moved rhythmically according to the predefined movement of the schedule, just as one would expect from a production machine.

### Workmanship of Uncertainty in the Machinery of Building

What was the role of craftsmanship and builders in the machine building at Moholt? Looking at the steady movement of the wagons from a distance, we imagined that the builders were playing the role of cogs in the machinery, striving to work according to the predefined course as smoothly and predictably as possible, not unlike the machine operators of mass production. Being inside the building, observing a single wagon in action, we saw carpenters, painters and other craftsmen doing handiwork. The carpenters were happy to have the floor to themselves, without having to step over plumbers or wait for electricians to install cable gates – situations that were apparently quite common at other building sites, but which the TAKT machine had ordered. Observing their work, we saw that plasterboards and listings were cut by hand and put into the timber frames with screwdrivers; measures were made with rulers or by eye; paint was put on the walls by hand. No robots or production machinery were present inside the building. Seen in isolation, the work on each floor resembled old fashioned craftsmanship, characterized by workmanship of risk. The craftsmen seemed to resemble “the living mechanisms” of manufacture more than “cogs” in the machinery of mass production; they were organic, more than mechanic.

Taktplan blokker Moholt 50 | 50 på plan av 150128, innvendigaktiviteter

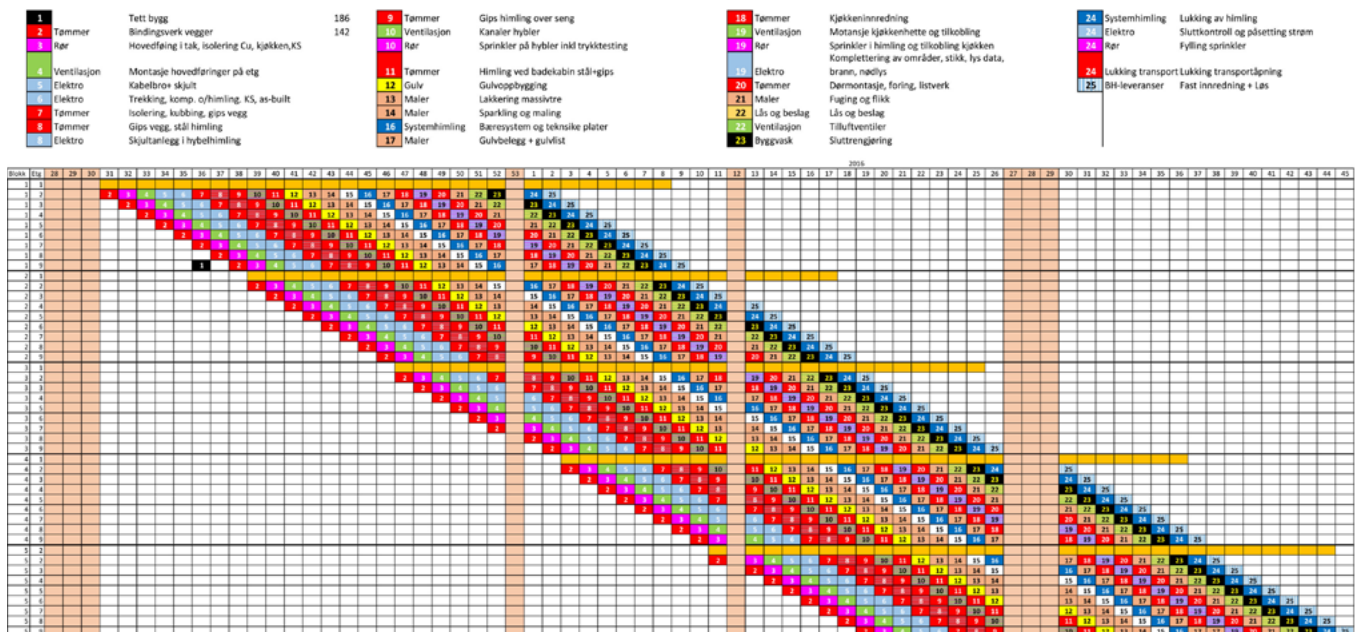


Figure 2: The Gantt diagram shows the plan for the building process. Horizontal lines show time, squares equal one week and vertical lines represent tower floors. Each wagon has an individual number and each craft an individual colour; one coloured field is the work of one wagon in one week. It might be difficult to see all the details in this image, but the idea is to show the complexity and general movement of the whole system, as a train working its way diagonally down the diagram. The light pink vertical lines that interrupt the general movement represent holidays; building halts for one week at Christmas, one week at Easter and three weeks over the summer holiday.





Another difference from machinery, which is routed permanently in steel, was that the character of the work changed over time. For example, the carpenters learned and found new ways of doing things (*kaizen*). After a few weeks, they stopped using rulers and cut plasterboard directly with their dexterous hands. They also had plasterboards delivered in increasingly efficient ways: rather than storing a large stack by the loading window, they spread them out in smaller stacks closer to the rooms in which they were actually being used. Even after thirty weeks, the carpenters managed to find new ways to improve their efficiency and reduce the number of workers in the wagons. As expected in lean construction, it was mainly the workers (e.g. the carpenters) who came up with these improvements and put them into effect; in this way, the workers' roles were more than simply parts in a machine.

But the builders were also less predictable than machine parts. They got sick and made errors, thus representing an element of risk for the goal of having the machine run at the exact pace of one floor per week. How was this handled? One approach was economic encouragement, requiring each wagon to compensate the subsequent wagon according to an agreed rate if they did not finish their floor in time (by Friday). Also, as their piecework rate required them to perform at pace, much of their income depended on them finishing on time. If a wagon was not finished by Friday, they had the option of working through the weekend to keep to schedule, but that option was rarely used; rather, the wagons almost always finished on time. When the builders were asked how they managed to keep the pace, several stressed that more important than the contractual arrangements was the shared understanding of how this building method worked and the *necessity* of keeping the pace. There was also a strong sense of shared destiny, as they all wanted to succeed. Thus, the different professions helped each other finish on time, and there were many informal agreements between wagons, providing flexibility by adjusting the strict schedule. For example, the electricians would allow the carpenters in the next wagon to deliver their stacks of plasterboards while they were still working on the floor on the Friday, and in return, they would be allowed to return to install the heaters after the painters had finished, later on. Such agreements were natural, given the holistic understanding of the building project and the mutual interdependence of the workers involved (Andersen 2017<sup>[1]</sup>).

The flexibility of the builders was absolutely necessary for the wagons to move at the right pace. Our impression from the building site was that much of the work – particularly for the crew leaders – consisted of solving the more or less unforeseen problems that occurred each day. There were many sources of unforeseen events; some were due to the human nature of the builders, while most had other causes. Such causes could include surprising discoveries made during groundwork or rough weather conditions. For example, strong winds could stop the building by preventing cranes from lifting large prefabricated elements in place, as the winds would blow these elements away, like kites.

The most important source of uncertainty was the JiT delivery of materials, components and services. The building plan was vulnerable, as it presupposed that everything would be delivered to the place in which it would be used at the time at which it would be needed. On a Monday morning, when the carpenters in wagon seven would be starting to put up the walls for fire protection on the fifth floor, the stack of plasterboards would be there, ready for use, as it would have been delivered through the window hatch on the Friday evening. The following week, the same delivery would come through the window hatch onto the sixth floor, and so forth. For this system to work, the plasterboard supplier needed to perform precise deliveries. If the boards came in too late, the entire train would halt. Thus, the producers and suppliers were enrolled in the pace of the building machine, just as the builders were – preferably by sharing the sense of a common destiny. This was managed sufficiently well by the suppliers who collaborated directly with the building project, but these suppliers also depended on third parties that were one step further away; further, some of these suppliers depended on even more distant suppliers. The more distant the supplier from the building site, the less likely they were to appreciate the importance of JiT delivery. Having suppliers and producers understand the principles of lean building and realize the importance of JiT delivery was said to be one of the most challenging tasks at the building site. Suppliers who were out of pace seemed to be the most common source of problems. This vulnerability called for the community of builders to improvise.

Small delays were handled by borrowing from other wagons, reorganizing the work order or finding useful things to do while waiting for a delivery. Major delays, however, needed major transformations in the plan. For example, a flood during the winter of 2016 destroyed the factory that was producing windows for the tower blocks. Suddenly, no more windows were coming and no new deliveries were expected for three months. This called for a series of sudden rearrangements to the work order.

Deliveries not only caused problems when late but also when too early. If the plasterboards for the carpenters in wagon seven arrived a week too early, the boards would fill the workspace and cause a mess for the electricians in wagon six. There was simply no place to store materials that arrived too soon. Such deliveries also required personnel to unload the truck as it arrived, and no one was happy about dropping out of their wagon to handle such tasks, risking a delay in their scheduled work. The message that deliveries should not arrive early did not reach all suppliers. One example pertains to the delivery of kitchens from an Italian producer. The exact date for the delivery was set according to the building plan and agreed with the kitchen supplier. The drive through Europe would take several days and a truck was sent from the factory at a precise time in order for it to reach the building site at the right moment. Once on site, the kitchens would be unloaded to a temporary storage. But miraculously, the truck transporting the kitchens arrived several



days ahead of schedule. In order to manage this, the truck driver, who had been hired for the occasion, must have broken all possible speed limits and neglected all possible requirements for resting time. He probably expected honour for arriving ahead of schedule, but instead was made to wait until the next day, when the truck could be unloaded. The truck driver was very unhappy, but unloading the kitchens ahead of schedule was simply not possible.

Yet another source of uncertainty pertained to the periodic building errors. Although the number of errors at this building site was said to be exceptionally low, they did still occur, and they required improvisation. For example, in one instance the attachment points for the lift system in one of the towers proved sixty centimeters off, and this prevented them from being installed. The carpenters' and lift fitters' drawings had not been properly coordinated, and showed different heights. In a complex building project, it is difficult to avoid such mistakes, but it seems that they can be handled by builders who are able to work in uncertain conditions.

Observing the building over time, we saw an almost constant stream of unexpected problems and builders engaged in solving these. This lends yet another dimension to their workmanship of uncertainty, implying that they held more than skilled, flexible and learning roles inside a larger machine. The craftspersons also worked *outside* the machine, as "machinists." Viewed as a machine, the building process at Moholt was not a modern engine that ran smoothly independently; rather, it was an old steam engine with all kinds of whims. The constant fettling and adjusting needed to keep it running called for the craftsmanship of a skilled machinist. The lean construction system at Moholt was a machine that required constant attention of a quite sophisticated kind, calling for craftspersons to improvise, communicate and rearrange plans.

### Planning

The plan for the building process at Moholt resembled the outlines of a machine: when set in motion, the causal relations between the rubrics of the Gantt diagram produced the desired results with a similar form of causality as when the parts of a production machine work together. The "building machine" ran smoothly only when the builders were able to follow the plan with precision and fettle and improvise to keep it running. But this was not enough. The plan also needed to be "buildable." Thus, it was essential for the builders to be involved in the planning process.

As described above, the planning practice at Moholt was called Involved Planning, and it had been developed within the company in collaboration with the researcher Lars Andersen (Andersen 2012<sup>[9]</sup>; Veidekke 2011<sup>[9]</sup>). The system built on the principles of lean construction and the Last Planner System (Ballard 2000<sup>[9]</sup>), but was more oriented towards the Nordic model of involving employees in decision processes and implied more worker participation in planning. The Involved Planning system included the builders throughout the entire building process, forming a systematic approach to

all levels of planning, from the general project design to the day to day planning. Builder representatives were involved in much of the planning that had traditionally been left to architects and engineers. At the other end of the spectrum, much of the planning that had traditionally been done by builders on site was moved into the barracks meeting room and formalized.

The lean construction system required a lot of detailed planning. As with most building sites, Moholt was initially planned by architects, and this initial plan was later developed into more detailed technical plans that were eventually made into specifications for each craft involved (e.g. plans for the electric system, the plumbing and ventilation systems, the firewalls, etc.). These more detailed plans were developed alongside plans describing the building process. Both kinds of plans needed to interact perfectly.

The structure of the tower blocks consisted of prefabricated wooden elements that were routed by robots at a factory and joined together on site. Within these elements, the holes for cables and pipes were also routed by the robots. The order in which the carpenters, plumbers, electricians and painters worked had to be reflected in the position of these holes. For example, because the wagon with the plumber came before the electricians, it was essential that the holes for plumbing were located inside the holes for the electric cables, so the sewer pipes would not block the electricians when it came time for them to pull their cables. Not only the holes, but a myriad of building logistics needed to be incorporated into the elements, together with detailed specifications for each of the professions involved. All this was sorted out and fed to the robots before any of the actual building work started. Thus, the participation of builders in the early stages of planning was essential, as only they knew their work in sufficient detail to feed into completely buildable plans. In these early meetings, the rough order of the building process – as shown in the Gantt diagram – was planned. However, much still depended on factors that could not be easily foreseen, and thus more had to be planned at a later stage.

Planning meetings were arranged throughout the building process. In these meetings, builders, leaders and engineers would meet to plan work for different periods of time, such as two months, two weeks or one week. For example, the foremen and crew leaders would meet every Thursday to plan for the next week. Every Monday, the carpenters would meet to plan for the current week. During these meetings, plans would be made according to the information at hand; the closer the meeting was to the time planned for, the more up-to-date the information would be. Therefore, it was important that planning was conducted at the right times, often as late as possible, to ensure the best information was available. For example, on Thursdays, it would be possible to predict rather accurately which builders would be present the following week and to plan the task for each builder in detail; on Mondays, it would be possible to know (for example) who had an appointment



with the physiotherapist on Wednesday at twelve o'clock. Such details could not have been planned two months in advance.

Planning has always been part of craftsmanship and improvisation, in terms of "looking ahead," and it stands in contrast to the articulation of the finished state that characterizes architectural drawings. While architects and engineers traditionally generate articulate plans, builders – as craftspersons – tend to plan along the way, whilst embedded in the actual building work (Ingold 2013<sup>[9]</sup>). At Moholt much of this planning was formalized in regular meetings, in which the builders took part in terms of both looking ahead and articulating the finished state. All in all, the builders spent more time making plans in the meeting room than they would have in a traditional building process. Still, the builders seemed to agree that they actually saved time by doing this, as the building went more smoothly, with fewer errors. Also, participation in planning was said to contribute to a feeling of having a say in their working situation and being included more fully in the project.

To plan in such detail and with such accuracy as the lean construction system required, it was essential that the crew leaders who were coordinating the plans knew the builders well. A crew leader stressed that they could never have built in this way without permanently employed builders: "It would be impossible to have this matrix work if I did not know the lads," he commented one Thursday whilst organizing tasks and people for the following week. "One working hour is never similar to another working hour," he said. "The difference can be as much as a hundred percent." Also, when unforeseen tasks arose, he needed to know exactly who could handle that particular job and who could not. For example, he knew that "Jon" would go mad if he had to screw roofing for four

weeks in a row, while "Paul" would actually prefer to have the same task for months. He also knew that "Simon" needed a proper task with good piecework pay, following his efforts in the basement. And when "Peter" came to him with an aching back, the crew leader was able to find him alternative tasks that would not cause him greater injury. Because the crew leader knew "Peter" well and could constantly adjust the plans, it was possible for him to negotiate the situation and avoid losing a good carpenter to sick leave. Had he not known the builders, he could not have managed this. This day to day negotiation of solutions suited the builders and was necessary for the successful implementation of the project. Solutions could not be standardized as in mass production, as the matrix of builders and tasks had more in common with a living polyphony than a Gantt diagram. They were more like crafted items – tailor made for each situation and flexible to accommodate moment to moment adjustments in line with unpredictable occurrences. Managing the building project required constant attention, as the result was constantly at risk. In this way, even the day to day planning on site was an aspect of workmanship of uncertainty.

Day to day planning of work tasks was not the responsibility of the crew leader, alone. It also required active contributions from the entire community of builders. When asked directly if he could have managed this process with casual workers, the crew leader asked how we thought Rosenborg, the local football team, would have performed if they had relied on hiring players from match to match. "Impossible!" he said. This analogy reminded us that the day to day fettling of the work matrix required more than knowledge of the players; the players took active roles in the polyphonic dialogue we call a community of practice, learning and developing together, and handling uncertainty together.

## Towards Sustainable Building Crafts

Above, we described the Moholt building project as one in which skilled builders interacted with each other, suppliers, the materiality of the building site and the robots that prefabricated the elements. The builders formed a community, applying their skills both within and outside the complex building system and constantly reformulating plans. In our eyes, this building project had some properties that pointed to a possible path for future building projects. Could Moholt represent a sustainable path for building crafts? We approach this question in terms of the three forms of sustainability defined above: cultural, social and environmental sustainability.

Cultural sustainability concerns the continuation or preservation of craftsmanship in terms of skill, culture and tradition. The increased use of prefabrication and robot technology is connected to a concern among builders about losing their craftsmanship and status as craftspersons and becoming "assembly workers." The negative connotations that are attached to this term can be linked to its association with mass production and assembly workers spending their days doing monotonous tasks it takes them fifteen

minutes to learn. The preservation of craftsmanship does not seem complementary to the idea that builders are replaceable parts in the machinery of building. In this sense, lean production models may be relevant, as they are generally more focused on the skills of builders and other workers. But lean has also been criticised for placing too much focus on organizational performance at the expense of worker status (Pil and Fujimoto 2007<sup>[10]</sup>). In this respect, Volvo's *reflexive production*, developed within the Nordic model, may serve as an alternative source of inspiration. At Volvo's experimental Uddevalla plant, the same team of skilled workers assembled the entire car, in sharp contrast to the task breakdown in mass production and lean systems. The car stood still while the workers moved around it, using mostly handheld tools (Ellegård 2007<sup>[11]</sup>). In this production system, the development and use of skills was more aligned with traditional craftsmanship, and this led to increased worker satisfaction (ibid.). We see some clear parallels between the system at Uddevalla and the Involved Planning principle at Moholt, even though the latter explicitly adhered to lean, with the TAKT principle producing an "assembly line effect" throughout the



buildings. The TAKT system was welcomed by the builders, as it gave the different wagons good working space by allowing them to have entire floors to themselves. But it also involved monotonous tasks for the builders. For example, even though most carpentry jobs began as craftsmanship of risk, these same work operations were repeated over forty floors, resembling the production lines of mass production. The crew leaders told us that they strove to rotate the builders in order to prevent them from performing the same task for too long. But not all of the builders wanted variation; some actually preferred the monotony of nailing identical plates of plasterboard for forty weeks in a row. Seen in this perspective, the idea that there is one narrow understanding of craftsmanship seems futile. At the building site, we saw a polyphony of skills in action, but as the builders worked in a community of practice, they complemented each other. The “polyphonically skilled” community may be a more fertile unit for analyzing the cultural sustainability of craftsmanship than the skilled individual.

Is craftsmanship threatened by automation? Although the builders at Moholt had concerns about becoming assembly workers, the constant uncertainty inherent in building projects made them rather certain that they would *not* be replaced by machines. Their skills as builders enabled them to handle unforeseen situations that, to date, no machine has been able to. For this reason, they seemed to believe that human craftsmanship had a future even in a world of machines, emphasizing elements we associate with workmanship of uncertainty. To the builders, the traditional skills of workmanship of risk were still needed, but their nature seemed to be transforming in line with developments in building technologies. In addition, they felt that automated production technology and lean construction systems put more emphasis than traditional building on the ability to *work with machines* in complex, machine-like construction systems. We describe this as working simultaneously *in* the machine as craftspersons and *outside* as “machinists” and planners, navigating uncertainty; these builders *were* the machine as much as they were running the machine. Such systems required the builders to work with not only machines, but also other humans in functioning communities of practice. This last issue was said to be essential for handling uncertainty, and an essential aspect of workmanship of uncertainty. If the practice at Moholt pointed to a culturally sustainable path, this path was not a museum-like preservation of old school crafting and building techniques; rather, it depended on sustainable communities of practice involving learning, using and developing high-level crafting skills in a transforming world.

As for social sustainability, which path did Moholt point to? When the first attempts at lean construction were introduced in Norway, there was some critique from labour unions – for example in a document published by NTL in 2011: “Yes to participation and trust. No to lean.” Some argued that the Nordic model of collaboration could be threatened by lean if the autonomy of workers was lost when standardized, short-term decision processes replaced the Nordic

model’s participatory decision processes (Ingvaldsen et al. 2012<sup>[9]</sup>). However, they also pointed to the possibility that lean principles could be adapted to accommodate the tradition of participation in Nordic work life. The system of Involved Planning can be seen as seeking exactly that, as it involves builders in the planning in a more fundamental way than in some versions of lean. For example, the lean principle TAKT, which was applied at Moholt, was said to be very different from the German version, which had a more top-down command structure. Lean and similar principles should be discussed in relation to the cultural circumstances they are adapted within. In this case, the Nordic model of work played a key role.

Seen from the perspective of builders and craftsmanship, another major issue regarding lean and lean-like practices is the business model of outsourcing that has come to dominate the building industry during the past decade. This model relies on casual workers on short-term contracts to achieve flexibility for the company office. The burden of uncertainty connected to winning or losing contracts is thus carried by the builders, who go from being permanent employees to not knowing whether they will have work the next day. This business model creates conditions for the builders – both Norwegian and immigrant – that do not appear sustainable in a social sense. The use of casual workers invokes the logic of mass production, wherein workers are seen as replaceable parts, rather than able members of a skilled community. The practice also seems to put the quality of the building at risk. If part of a company’s workforce is temporal labour, then the quality of production can be secured by various control systems (as exemplified by Pål and Fujimoto 2007<sup>[10]</sup>). However, if almost one hundred percent of a workforce consists of temporal labour, the community of practice is destroyed and, with it, the level and development of the workers’ crafting skills. The role of the community is particularly obvious in complex building projects. Builders at Moholt stressed that they could not have built in that way if they had not been permanently employed builders who knew and trusted each other. This was also key to the company’s competitive advantage: by relying on a steady community of skilled workers that had been trained by the company, the company was able to achieve a high level of skill and handle complex constructions, enabling them to build quickly and with few errors, and thus to compete with companies relying on cheaper, temporal labour. In contrast to temporary workers, who provide certainty in an uncertain situation by living uncertain and precarious lives, a community of permanently employed builders provides certainty through workmanship of uncertainty. Although some critiques of lean construction might hold weight in this scenario, lean seems far better suited to accommodate sustainable social conditions than outsourcing, as it requires skilled communities and thus permanent employment. In combination with Involved Planning, it also seems to take a step towards the Nordic model of worker involvement.

Finally, lean building practice is also relevant for environmental sustainability, as the constant focus on eliminating waste (*muda*)



contributes to a building process that minimises material use. Further, the ability to build with accuracy and few errors is important for achieving low-emission buildings (such as the Moholt tower blocks), which are characterized by technological complexity, a need for high accuracy and tightness and great negative consequences for building errors (for example, in terms of moisture damage). The engineer responsible for the environmental aspects of Moholt stated that they would not have been able to achieve these results without the active involvement of the builders. Other companies might have been able to achieve the same results in other ways, but when the builders left Moholt, they had managed to finish on time, below budget and apparently without serious errors. Also, they had avoided major injuries and had almost no

short-term sick leaves. The leaders told us they were certain that they would continue to develop down this path.

A general conclusion regarding craftsmanship is that high-tech building projects that are increasingly characterized by prefabrication and complex building systems do not diminish the importance of high-quality craftsmanship. Rather, the quality of craftsmanship may be even more important, though it is transformed into a craftsmanship of uncertainty, with greater emphasis on improvisation, planning and collaboration. These skills should be approached as collective skills, and the results they produce should be subject to the same kind of professional pride as more classical skills. Thus, technologization does not necessarily imply a loss of craft

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# ABOUT THE COVER ARTIST

## *Rebecca Hutchinson*

By Ivana Suboticki

**Rebecca Hutchinson** is an artist and Professor of Ceramics at the Artisanry faculty at UMass Dartmouth. She has mostly worked with large-scale installations and her works have been exhibited in the National Museum of Women in the Arts in Washington, The Clay studio in Philadelphia, San Francisco Museum of Craft and Design, Taiwan Ceramics Biennale, Keramikos Internationale della Ceramica D'Arte, to just name a few. She is also the recipient of the 2015 Women to Watch Award and New England Artist Award, as well as numerous fellowships. Recently influenced by the observation of ecosystem dynamics, developmental theory, and environmental concerns, her work engages with nature in all its complexities and multiplicities. Through sculpting and crafting specific physical artifacts made of clay and recycled materials, her installations are examining the human

condition. She usually develops site-specific, or site-responsive works, where she uses observations as a key way to conceptually develop her installations.

**Tranquil Bloom Detail** featured on the Cover of this issue, is made of fired and unfired porcelain paper clay, handmade paper, and organic material. One of the most compelling aspects of piece is that the artist upcycled one million dollars off-line currency and sculpted it into flowers. In this way, our interpretation and understanding of value is reframed through craft. The million-dollar piece was exhibited at Northern Clay Center, Minneapolis Minnesota, USA.

To learn more about *Rebecca Hutchinson* work, visit: [www.rebecca-hutchinson.com](http://www.rebecca-hutchinson.com) or read her opinion piece in this issue



# SUSTAINABILITY AND CRAFT

## Opinion Piece

by Rebecca Hutchinson

### A bit of background on my work

I have been influenced by the natural world – by the use of earthen materials and inspired from species' form. My work is shaped by ecosystem observation and researched historical botanical motifs found in historical craft (domestic handcrafted items such as Persian rugs and Victorian lace). The sculptural work is made for the wall and floor, and connects site specifically to architecture. It focuses, formally and structurally, on the respect for process. My interest is in the details: quality of craft, connections, and structure. Conceptually, I explore sustainable relationships within the ecosystem through craft to gain an understanding of all physical parts to the whole. These site-responsive clay and fibrous sculptural works

are made from recycled 100% natural fiber clothing or harvested garden materials beat down to pulp and formed into handmade sheets and shapes. I also use industrial castoff surplus materials, like cotton thread from the bedding industry, sisal from the burlap bag industry, or upcycled off-line currency, combined and attached with clay. Like a bird or squirrel that uses the vernacular from place, I, too, upcycle humble materials and remake them into what I hope to be exquisite sculptural forms, utilizing the vernacular-harvest as content and, through craft, a refined formal quality.

My early work was an exploration in gathering materials and developing form. The forms acted as both a vessel, with reference to



**Left:** Warehouse Installation at The Archie Bray Foundation, Helena, Montana. **Right:** Installation at Perlman Teaching Museum for exhibition *Swing Low*, Carleton College, Northfield, Minnesota, fired and unfired porcelain paper clay, handmade paper, organic material, 99" x 96" x 14'4"



safety and home, and a reflection on communal existence. I made form next to form, investigating the charged space and proximity among the forms, as well as the space available to the viewer to walk among the works. Presently, I am referencing observed plant behavior; the work is more engaged with the theme of thriving and productivity. I continue, through observation, to look at diverse states: structure of nature, the interaction of various and competing forces of nature, biological diversity, and the resilience of life itself manifested as the struggle to grow, expand, reproduce and nurture.

The sculptures, some of which sit on the floor, some that are suspended from the wall, all- connect to architecture. Like the growth of weeds, they connect and grow around something that may have lost its purpose. Like new life moving in, quietly repurposing space, they are nestled in amongst the layers of history. Working on site has always been a process of listening to space and then, after listening, connecting and interacting to offer new insights to the architectural reality. Materially, I combine my knowledge of two specialties: ceramics and hand-made paper. Clay and fiber, like a species' choice for animal architecture or like architecture made by indigenous cultures. It is a perfect fit structurally and conceptually.

Don Wilkinson, author of *Diverse States of Existence: Instinctive Formations at Shattuck*, writes about my current work:

*Her work is largely botanical in appearance. There is a common tendency to create great divides between big disciplines such as art and science. But Hutchinson is having none of that. As the daughter of*

*scientists, she has a raging curiosity and a learned point of view. Her sculptures are the result of careful observation, informed decisions and a meticulous handling of materials. She digs into the muck, both figuratively and literally, physically and spiritually embracing nature as her muse. In works collectively called the "Determinate Growth" series, she takes inspiration from root systems, rock outcroppings, moss, the forest floor, invasive species and the species that fight against them, the strength and fragility of small- and large-scale ecosystems, floral beauty and ferocity, and plant formations of all kinds, ecophysiology, the biological discipline that studies the adaptation of an organism's physiology to environmental conditions. Hutchinson constructs the sculptures by combining the clay and paper elements in such a manner that they seem to have always coexisted. The individual components are brought together in a composite harmony with the application of a mixture of paper pulp and clay, seemingly as thick as peanut butter, which acts as a near-indestructible bonding agent as it hardens. They are tatterdemalions transformed into something that manages to be both earth bound and ethereal<sup>1</sup>.*

#### Craft

When reflecting about the act of making, I acknowledge that craft is about connection, the intimacy of connection. Literally hand to material and hand to a tool, or when needed, hand to equipment. In addition, intimacy of connection occurs formally. Formal devices such as color, line, pattern, and space guide form until aesthetics begin to work in a syncretic way. Looking good, looking masterful, requires all visual parts working together towards beauty. Also, in my work, the crafted object has a connection to place. I respect



**Left:** Installation view from *Form and Nature*, Turman Larison Contemporary, Helena, Montana **Right:** *Orange Burst*, fired and unfired porcelain paper clay, handmade paper, organic material 60" x 60" x 12"

<sup>1</sup> Wilkson, Don. "Diverse States of Existence: Instinctive Formations at Shattuck". *Artscope Magazine*, May/June 2016. Print.





and enjoy the various organizations I must interact with or specific departments within the museum organization. I have roles with curatorial, marketing, and preparatory staff, engaging with them all as the large site works find "home". The act of making employs literal touch connection, aesthetic connection and, in my work, a physical connection for the viewer to (hopefully) visually enjoy.

Craft requires interaction and respect for the "other" to make this connection. It is through the connection of hand to tool, that a sensitive mark results. It places the maker as the listener, the negotiator, the requester, then the engager. The respect for this connection to the tool or to the material completes the desired end result. The completion of task is an act of collaboration. The maker is the humbled requester for this interaction. The act of making connection is collaboration. The maker moves from the "I" did it role to the "we" committed to this to gain a result. Whether it is hand in tool, hand on material, or formal visual mastery through part of object to parts of object working together, the role of making craft is an active

### Sustainability

Making and craft is a micro model for sustainability. The making takes more than the "I," it proceeds into the "we", engaging in respect for the parts to the whole. Craft functions in participating in the "whole," which in turn encourages the most fundamental role for sustaining on the earth: participation in multiple components, upholding respect beyond one entity or one motion for completion. It celebrates that all components are essential and important.

In nature (spider web or fungus growth, for example) there is intimate, if not instinctual, knowledge of all aspects to a decision of how things are built knowing what is connected to what. The craft of nature, the craft of humans, offers the model for transformative behavior, to change human approach to existence. It can move our decisions to researched responsible connection directions. Understanding all parts to the whole means respect for everyone and respect for everything. We have the ability to render new progressive thinking.



*Tranquil Bloom with detail, fired and unfired porcelain paper clay, handmade paper, organic material, 12' x 17' x 13'*