

“I LOVE IT”

Caring for second-hand inventory in a university living lab

by Dr. Ruth Woods, Thomas Berker, Dr. Thomas Edward Sutcliffe & Hanne Marit Henriksen

Reducing greenhouse gas (GHG) emissions through renovation of the existing building stock is high on national and international agendas, but a broader understanding that includes building inventory and the circular economy is not often included. By 2028, the Norwegian University of Science and Technology (NTNU) plans to consolidate university campuses and rehabilitate up to 45 000 m² of buildings. There are some signs of circular economy at the university in institutionally established practices such as waste sorting, and green procurement, but there exists a greater potential. In 2021, the authors organised a living lab at the university, aiming to investigate whether further measures could be implemented to reduce the consumption of university inventory, such as furniture and computer equipment. We found that reuse, in contrast to the centralised administrative provision of inventory, encouraged practices of care. The experiments in the living lab addressed the dominant homogeneity and standardised character of university fixtures and fittings, provoking enthusiasm for previously discarded and unwanted objects and offering opportunities for new caring relationships. The paper asks, in what ways caring practices are performed in efforts to reduce consumption and achieve sustainability goals in complex organisations such as universities. Data was collected during experiments organised as part of the living lab. The caring practices that we identified are context-aware, empowering, egalitarian, and avoid prioritising some kinds of practices and objects over others.

Keywords: Care, universities, sustainable consumption, reuse, circular economy

Author: Dr. Ruth Woods, Research scientist,
Department of Interdisciplinary Studies of Culture, NTNU

Thomas Berker, Professor in Science and Technology Studies,
NTNU's Centre for Technology and Society.

Dr. Thomas Edward Sutcliffe,
The Department of Interdisciplinary Studies of Culture, NTNU,
Researcher at the Norwegian Institute for Nature Research.

Hanne Marit Henriksen, PhD student,
Department of Interdisciplinary Studies of Culture, NTNU

Licensing: All content in NJSTS is published under a [Creative Commons Attribution 4.0 license](#). This means that anyone is free to share (copy and redistribute the material in any medium or format) or adapt (remix, transform, and build upon the material) the material as they like, provided they give appropriate credit, provide a link to the license, and indicate if changes were made.



Introduction

A woman who had become the proud owner of a used black office sofa told her friend that she "loved it" as they carried the sofa out of a reuse zone to its new home on campus. In many ways the sofa and its owner were a match made in heaven; a practical need, not having somewhere comfortable to sit, was met by a sofa that needed a home, and as the common fate of similar items, the sofa would probably have been discarded. A reuse zone organised as part of a living lab on the Gløshaugen campus at the Norwegian University of Science and Technology (NTNU), helped the sofa to find its new home.¹ The reuse zone gave university furniture, digital devices, and miscellaneous office equipment away for free to students and university employees. The Gløshaugen campus is at the centre of plans for an upgrade, that includes approximately 91 000 m² of new and rehabilitated buildings by 2028.² Although rehabilitation of existing buildings is central in discussions about how to reduce greenhouse gas (GHG) emissions (EU COM 2020), a broader understanding of the circular economy involving building inventory or green procurement is not part of the Gløshaugen concept. There are some signs of a circular economy in institutionally established practices such as reuse, waste sorting, and green procurement. Despite these actions there exists a greater potential, and as the story about the black sofa indicates, more circular activities could meet needs within the social context of the university.

The Gløshaugen living lab started with the idea that more could be done with the circular economy to reduce consumption of inventory in the context of the university's declared desire to reduce carbon emissions (Skaar et al. 2019). The focus on university inventory was initially inspired by anecdotal evidence where perfectly usable furniture was seen being discarded in large quantities by the university employing the authors of this article. Individual observations of a lack of care for inventory at the workplace were reinforced by a short feature produced by the Norwegian Broadcasting Corporation (NRK) which showed mountains of office furniture disappearing into skips. This caused an interest in the routines and practices associated with the reuse of furniture and other inventory, as well as the practices related to procurement.

Buildings on university campuses are expensive to maintain and manage. Storage space is limited and storing unwanted items is a challenge on university campuses. There is also an interest in reducing waste within the university system. In 2019, NTNU stated that it aimed to "reduce the amount of waste by 15% compared to the 2011 level and at the same time increase it the sorting percentage to 85% by 2020." (NTNU 2019). NTNU's Property Division introduced several actions to achieve these aims, i.e. a digital market for the reuse of furniture and equipment and changes in the use of transport on campus. In collaboration with university's Property Division, a living-lab was established where we investigated whether existing circular practices could play a larger role on campus and if there is room for new ones. Moreover, we asked whether employees and students are willing to accept a significant increase in reuse, recycling, or the postponement of investments in new equipment.

A caring, and at times, joyous approach (i.e., loving a black sofa) to reusing previously unwanted objects was observed in the reuse zones that were temporarily established as part of the living lab. The interest by students and employees for the objects showed signs of care. When caring we are often maintaining, repairing, cherishing, and selecting (Fisher & Tronto 1990; Martin et al. 2015). Activities that are closely related to principles associated with the circular economy (European Commission 2023). The paper therefore asks, in what ways caring practices are performed in efforts to reduce consumption and achieve sustainability goals in complex organisations such as universities. The question is answered by first placing the activities from the living lab within the context of the circular economy and care theory. This is followed up by the methodology which clarifies the ZEN Centre's approach to living labs. The empirical section has a narrative approach and provides stories about the care for reused objects found in the reuse zones. A concluding discussion addresses the untapped potential within universities to enable and participate in circular-economic practices.

Reuse and the circular economy

Reuse is a re-actualised practice, which, in recent years, has become central to European and national climate, environmental, and industrial policies commonly grouped under the banner of the circular economy concept (e.g., European Commission 2015; 2020). This concept is interpretive and definitionally flexible but refers

generally to a model of production and consumption that involves practices of reuse, sharing, leasing, repairing, refurbishing, and recycling existing resources and products (European Commission 2023). As a consequence of strategic policy development, the circular economy concept has been growing in relevance in industries,

¹ NTNU is Norway's largest university with 40 000 students and 6 500 employees. The university is located in three cities, Trondheim, Ålesund and Gjøvik. The largest campus, the Gløshaugen campus, is found in Trondheim.

² The original plans proposed 92 m² of new buildings and 45 000 m² of rehabilitated buildings <https://www.ntnu.no/campusutvikling/tidslinje-campusutvikling>. This has now been reduced due to state budget cuts <https://www.statsbygg.no/prosjekter-og-eiendommer/ntnu-campusamling>.



governments, businesses, and environmental organisations across scales. Until now, actions for a circular transition have tended to emphasise measures within the waste management sector, or post-consumption practices (Maitre-Ekern, 2021), but have also focused on efficiency strategies aiming to reduce primary resource input and energy demand (Bimpizas-Pinis et al. 2021).

Parallel with the heightened relevance of 'circularity' at the European policy scale, there is a goal in Europe to reduce the carbon emissions associated with buildings to zero (Energy Performance of Buildings Centre 2021). However, building certifications and investigations about the environmental impact of buildings rarely include the emissions associated with furniture and other inventory (Hoxha & Jusselme 2017; Lauvland 2021). Hoxha and Jusselme (2017) in a study of assessment of the environmental impacts of furniture and appliances used in highly energy efficient buildings, found that furniture and appliances were responsible for around 30 % of GHG emissions and non-renewable energy consumption and 15 % of primary energy consumption when compared to the overall impacts of the building. They also noted that, how to deal with furniture that is no longer wanted is usually not included in strategies for the follow-up of buildings. In 2017, from 80 % to 90 % of European furniture waste was incinerated or sent to landfill, and only 10 % was recycled (Forrest et al. 2017).³ The reuse of furniture has become more common, but it tends to be small scale actions, rather than larger scale environmental ones. Where reuse does occur, it is mostly through commercial second-hand shops, social enterprise companies or charities (Ibid).

The role of buildings and infrastructure is also of relevance in the circular economy literature. For example, Mendoza et al. (2019) report a lack of studies that analyse the implementation of circular economy thinking in universities. They use the University of Manchester as a case study to identify, evaluate, and prioritise intervention areas for circular economy business model innovation. The authors identified that refurbishment of existing inventory, predominantly furniture, was viewed as a priority action for the university. A key principle of a circular economy is extending products' lifetime, which entails an expansion of repair

and maintenance practices. Bugallo-Rodriguez and Vega-Marcote (2020), for instance, argue that universities have a valuable role in disseminating the circular economy as a new sustainability paradigm. How this is done is also under researched, as identified, for example, by Serrano-Bedia and Perez-Perez (2022) in their review of the role of higher education institutions as central supporting stakeholders in circular-economic transitions. Here, the authors identified a sub-group of circular economy literature they categorised as 'campus management'. Serrano-Bedia and Perez-Perez (2022) frame initiatives and activities under this category as contributing to the cultivation of circular economy mentality and eco-responsible citizenship; highlighting that university campuses can act as ideal places for testing circular economy activities. Our paper is a direct contribution to the marginal literature on this issue and seeks to contribute to better understanding how circular economy practices can be implemented in higher education institutions.

According to Stahel (2016: 435), "Quality is still associated with newness not with caring". As such, the idea of newness as opposed to reuse is a critical element to address in a transition to increased circularity. Newness is relevant to the Gløshaugen living lab, as NTNU campuses throughout their lifetime have been subjected to the renewal of their facilities, e.g., offices, laboratories, study areas and canteens. In most instances, the campus renewals entail the acquisition of new inventory, including electronic equipment and furniture.⁴ Therefore, while there are established reuse practices at the university, there is still more that can be done if public procurement is to reach sustainability goals, which is a priority in the Norwegian circular economy strategy (The Ministries, 2021). The reuse of inventory and the testing of circular economy activities can be seen as an effort to address how we value unwanted items. What we value, why we value things and who decides what is valuable is far from clear. In a perfect situation everything is durable with an infinite lifespan and stable value. Unfortunately, many of the objects around us have a transient value, that constantly decreases until they reach the non-valuable category of rubbish (Thompson 2017). Objects can however be re-discovered and through creative processes re-evaluated and re-interpreted.

Conviviality and care as strategies for increased circularity

An alternative avenue for sustainable and more circular activities in universities is a convivial approach to the circular economy (Genovese & Pansera 2021). The approach emphasises the interdependence between people, technology and the world around us. It implies an orientation towards socio-technical pathways that surpass modernity, contributing to social and ecological justice through collective action (Stirling 2015). Ivan Illich (1973) saw conviviality as

promoting the satisfaction of needs through individual skills, learning and creativity, as well as through autonomy from industrialisation and commodification. Our approach considers how caring practices along with conviviality can become a central building block in existing and new circular-economic practices of higher education institutions related to how they manage inventories of miscellaneous equipment, electronics, and furniture.

³ More recent figures specifically for furniture are currently unavailable.

⁴ <https://www.statsbygg.no/nyheter/forskningsutstyr-for-milliardbelop>



Caring practices are between people, and between people and things, and they can create connections between public and private values. Fisher and Tronto (1990: 34) provide a broad definition, where care is “everything we do to maintain, continue, repair our ‘world’ so that we can live in it as well as possible.” This idea of how we repair or maintain our world is essential to understand reuse as an active and caring approach towards achieving a sustainable future.

In feminist scholarship, the concept of care is applied to describe the work and responsibilities involved in maintaining the wellbeing of others, i.e., health care, childcare, or caring for the elderly (Mol et al. 2010). Practicing care represents a dedication, concern, and attachment to others (Kleinman & Van der Geest 2009), it also tends to be highly gendered, with women being associated with unpaid caring responsibilities (Martin et al. 2015). Furthermore, caring practices are often unaccounted for in economic conceptualisations of labour, despite being essential for maintaining wellbeing (Fisher & Tronto 1990; Puig de la Bellacasa 2011; Martin et al. 2015).

By taking a used and previously unwanted object into their possession, in our case a piece of second-hand university inventory, a person is expressing an active desire to engage with the object. People are dependent on care and so are technologies and objects. This implies “tinkering”, where practices, situations and tools are adapted to suit individual and collective needs that address complex and shifting tensions (Mol et al. 2010: 15). Care has a place in sustainable practices that are outside the controlling and universal technological focus that we recognise from the modern world (Arora et al. 2020). It also challenges established consumption practices that are based upon seemingly endless growth and affluence (Syse & Müller 2015). Consumption practices are part of consumers’ identities which seem difficult to change because they are closely connected to how we present ourselves to the world (Giddens 2008). Godin and Langlois (2021) propose that this could change if care and caring are prioritised by society. Caregiving and care-receiving point to vulnerability and the interdependencies that make it possible for us to be part of the world (Puig de la Bellacasa, 2011; Godin & Langlois 2021). The reuse of second-hand inventory or furniture implies maintaining, repairing,

and caring for objects that do not have a place in the world and require help to find a place. It also suggests an interest in the history of the object and a willingness to repair and adapt it to other uses, and needs, that may be as diverse as the people who are interested in the reuse of these objects. Objects, in our case university inventory, degrade when there is a lack of care. What is required is a willingness to tinker, to adapt objects to the situation and to adapt the situation to the objects at hand (Mol et al. 2010).

A caring approach avoids normative, one-size fits all solutions, and the pitfall noted by Puig de la Bellacasa (2011: 100) that “a way of caring over here could kill over there.” The challenge is that this selective mode of attention, which means valuing some things, can end up excluding others (Martin et al., 2015; Lindén & Lydahl 2022). However, what is selected can provide a direction to follow, in our case second-hand objects rather than the newly procured. Caring for second-hand objects privileges interdependence, rather than hierarchically-ordered categories of the good, the bad, the new, the old, the ugly and the beautiful. When care is practiced subjects are interconnected in diverse relational webs that are horizontal rather than vertical. People and things can be different, but caring means solidarity and collectiveness that is based on the acknowledgement of difference (Arora et al. 2020). It is also a grounded and situational approach that prefigures humility and learning from each other as key to achieve more sustainable solutions (Jasanoff 2018). People and objects require care that is adapted to their needs in ways that highlight and promote neglected things, respecting them and engaging with what they could become (Puig de la Bellacasa 2011).

Taken together, circular economy activities in universities, care and the role of buildings and inventory in sustainability transitions provide a framing that allows for a research design that emphasises an active and heterogenous approach to university inventory. Where sustainability goals on European, national, and administrative levels at the university are given a local social context involving students and employees in a living lab on the Gløshaugen campus in Trondheim.

Methods: a living lab approach

The ZEN centre chose living labs to involve and engage citizens with the technical innovations being developed. A ZEN living lab is defined as a creative arena for knowledge exchange, between people, places, and technology (Woods et al. 2019). This definition is associated with qualities that inspired the first living labs at MIT during the 1980’s where the intention was to study people and their interaction with new technologies in a living environment (Schliwa & McCormick 2016).

The Gløshaugen campus was one of nine pilot neighbourhoods

associated with the Research Centre for Zero Emission Neighbourhoods in Smart Cities (ZEN). The centre aimed to develop emission-free neighbourhoods that reduce their “direct and indirect greenhouse gas emissions towards zero within its life cycle”.⁵ Living labs, experiments and interventions are often about supporting interests and avoiding potential opposition (Evans 2011; Bulkeley & Castan Broto 2013). In the present case the strategic interest was promoting ZEN’s zero emission research and its relevance in urban sustainability transitions. Furthermore, the living labs were intended to avoid discontent with technical innovations that are the focus of the centre. Overall, the

⁵ <https://fmezen.com/about-us/>

living labs provided what Janda and Topouzi (2015: 517) call “learning stories”, which were co-produced together with the recipients of the innovations in the context of the living lab. As part of this, ZEN’s living labs offered stories of opposition to the goals associated with the ZEN Centre. The challenges uncovered by the ZEN living labs can briefly be summarised as arising from a mismatch between the universal solutions that the zero emission technologies represent and the challenges and needs of the local contexts provided by the pilot projects (Woods & Berker 2019; 2020; 2021).

The stories from the living labs also highlighted the potential for opposition in communities where research was taking place and showed that communities do not always react positively to being considered test beds, being experimented on, or being defined as a pilot project (Woods & Berker 2021; Hobson & Marvin 2007; Bulkeley & Castan Broto 2013). When designing experiments to consider the relevance of technical solutions for a reduction in GHG production within a pilot project, ZEN’s research team learned to expect challenges when engaging with the social context the pilot project represented. It came therefore as a surprise that the experiments that were part of the Gløshaugen living lab should provoke enthusiasm and even expressions of joy.

The Gløshaugen living lab

ZEN’s living labs are based around four main criteria (Woods et al. 2019). Living labs are often problem based (Steen & van Bueren 2017), and ZEN’s living labs start by identifying a challenge or problem within the local social context. In the Gløshaugen living lab, the challenge identified was the comprehensive discarding of university inventory. The second criteria is a clearly

defined geographical space, and the third, is the involvement of representatives from different local groups. In the Gløshaugen living lab, the campus was the location, and the participants were students and employees, both academic and technical staff. Experiments represent the final criteria for the living labs. These should ideally be an action that engages with citizens in the neighbourhood (Sengers et al. 2016).

The Gløshaugen living-lab activities and experiments took place from May 2021 until June 2022 and were associated with three main phases. Each phase is briefly presented in Table 1. At the end of each phase, we evaluated the process and the empirical data gathered. The following phases and associated activities were planned and developed based on the evaluations. In each phase we worked closely with eight experts from NTNU. Six were working with either reuse or recycling, and two with procurement. They were each recommended through NTNU networks as “experts” in their fields. They provided valuable input about existing activities and the challenges associated with NTNU’s strategy for the reduction of waste on campus.

Data collection was approved by the Norwegian Centre for Research Data, and privacy protection standards were strictly adhered to. All informants are anonymous. People came from a wide range of different cultural backgrounds, reflecting the international character of the campus, but we have not collected the ages or socio-cultural backgrounds of the people that we spoke to. Students and university employees were of different genders and ages ranged from their early twenties, to people that we suspected had already started their retirement.

TABLE 1

When	Method	Who	Number of participants
Phase 1: Autumn 2021			
	Conversations	Experts from NTNU	8
	Site visit and observations at university recycling centre & storage spaces	Experts from NTNU	5
	Rapid interviews carried out by 8 students on two campuses in Trondheim	Students and employees from NTNU	100
	Two workshops where experiments were co-designed	Workshop 1: Students Workshop 2: Experts	Both workshops - 28
Phase 2: Winter 2021/22			
December 2021 Experiment 1	Christmas calendar in collaboration with NTNU’s digital recycling platform	University employees. Information about the calendar was available on the university intranet. Some students chose to participate.	Approximately 400 invitations by email were sent to university employees.
January 2022	Follow-up interviews about the calendar with employees and students	University employees and students	10
Phase 3: Spring 2022			



March 2022 Experiment 2	Three-day event with reuse-zones on NTNU's Gløshaugen campus	University employees (including the property division) and students	125 (179 objects)
June 2022	Expert evaluation	NTNU experts	6

Table 1: The three living lab phases

Phase 1: Interviews and a questionnaire

During the first phase we addressed an initial question, which was whether employees and students are willing to accept a significant increase in reuse, recycling, or the postponement of investments in new equipment. Conversations with the experts and a site visit supplied insight about reuse practices at NTNU. In addition, the rapid interviews that a group of students carried out on two university campuses in Trondheim during the first phase provided background information to understand reuse practices and expectations among students and employees. Firstly, 82 % of the 100 respondents reported that reuse is an important part of everyday consumption.⁶ This was primarily about sorting household waste but buying second-hand clothes and furniture was also mentioned. Secondly, 97 % of students and of employees responded positively to the suggestion that second-hand furniture could be used in new or refurbished campus buildings. Thirdly, students and employees were generally critical of NTNU's sustainable practices, they believed that there is very little in place and that what was in place was poorly communicated. Finally, they maintained that NTNU's reputation will be on the line if nothing is done to increase the reuse of furniture and other university equipment. One student even went as far as to suggest that "Armageddon" would result if NTNU did not change its practices.

The response during interviews and when answering the questions from the questionnaire indicate a general readiness among students and employees for the reuse of university inventory. However, in the follow-up workshop, the experts questioned the alleged positivity towards reuse at the university. They stated that their efforts to encourage reuse of inventory had been met by resistance. The experiments developed gave us the opportunity to examine whether there is a difference between what students and university employees said about their willingness to accept an increase in circular practices in the context of working or student life, and their actions when the opportunity arose to reuse objects. The experiments offered suggestions about what new practices at the university could look like.

Phase 2: A Christmas calendar experiment

The second phase included an experiment that took place in December 2021 and was a Christmas calendar, where employees could win a different piece of free university inventory every day. The data from the first experiment is limited. More than 400 employees received the calendar by email, but it is unclear how many participated and privacy issues meant that we were unable

to send the calendar to students at the university. The focus of this paper is the reuse zones that were part of phase three. This was where we had most contact with students and employees.

Phase 3: Experimenting with reuse zones

Three reuse zones took place in March 2022 over three days in two buildings on the Gløshaugen campus. Each day lasted approximately six hours from 9 am until 3 pm. The experiment with reuse zones was supported logistically by six experts from NTNU's property division. They supplied inventory for the zones and transported objects between different parts of the university. The zones included a variety of free and unwanted items that had been collected from the NTNU campuses. This included furniture such as office chairs and tables, electrical items (coffee makers and microwaves), digital technologies (computer screens and cables) and numerous other small and large objects which may be found in offices and meeting rooms on Norwegian university campuses. The items collected stemmed from relocating processes that resulted in redundant furniture due to, i.e., lack of space or incorrect measurements, and other goods that were not considered useful in the new location. Other items were a result of a tidy-up in storage rooms at different departments. The experiment was announced in ZEN's monthly newsletter and through NTNU's intranet for employees. Privacy policy at the university again meant that we were not able to reach out to the students through intranet or email and this meant that students found out about the zones by word of mouth. We noted a marked increase in student participation during the third and final zone.

In total 125 people picked up one or more items. Of these, 47 were students and 78 were employees. The university is a state-owned organisation and cannot earn money from the sale of its property, giving things away on campus ensured that a lot of the things remained in the university system. Some objects ended up in home offices, kitchens, and bedrooms but the property division accepted this was a result of the experimental nature of the living lab. Everyone who took an object was asked to fill out a short anonymous questionnaire. We asked what the new owner planned to do with the object, what it replaced and what they planned to do if they decided that they no longer needed it. People gladly filled out our form, they even asked if there was more that they could do. We experienced this as an unusually enthusiastic response to a questionnaire. The results section presents some of the observations that were made during the re-use zones that connect reuse, circularity and practicing care within a sustainable university context.

⁶ The Norwegian word for reuse is "gjenbruk". In the interview guide and questionnaire, we asked informants to tell us about their "gjenbrukspraksiser" "reuse practices". Informants understood this in terms of several practices such as recycling rubbish and buying second hand clothes and furniture.

Results: Stories from the reuse zones

In the reuse zones connections were made between what was said during the rapid interviews in phase one and the potential that exists in extending circular practices at the university. When students and employees were given the opportunity to take previously unwanted items into their offices, clubrooms, classrooms, and homes they responded positively and even joyfully. When they filled out our questionnaires and spoke to us about the objects available in the reuse zones, students and employees told us that they were happy to reuse university inventory and they expressed enthusiasm about the opportunity to do this on campus. On the first day, people lined up half an hour before the zone opened. There was the feeling that we had opened a "jumble sale" (Loppemarked), a typical second-hand activity in Norway and one that resembles Clifford Geertz' (1979) description of a Moroccan souq, or bazaar; a hectic, noisy place, with excited people, where piles of assorted wares are thoroughly examined (Geertz 1979). We struggled to meet the demand, and on the first day almost ran out of objects to give away. During the three days that the reuse zones were in place a total of 179 objects found new homes.

We received very little negative feedback about the reuse zones. Some of the technical staff in one of the buildings where the zones were located worried about us blocking escape routes, but we moved things around and solved that problem. Three different social groups associated with the university; academic staff, students, and technical staff, are represented in the stories that follow. In each story there is an active approach to the unwanted objects and the need to reuse them, that is reflected in Fisher and Tronto's definition (1990) where maintenance and repair of the world is central. Different categories of caring practices are present in the stories, tinkering, solidarity, and planning for the future. The stories offer insight into the caring potential found in reuse at universities, where objects become wanted and valuable again.

A perfect match through tinkering



Fig. 1. Trine and Audun's "new shelves". Photo published with permission from informants.

The story about tinkering refers to Audun and Trine, who both work at the University, and the shelves they gave a home to. The shelves were found by Trine and were lying in a pile on a wooden pallet, still in their original boxes with the maker's name on top, looking like a very large puzzle. They were easily the largest item in the reuse zone and very few people had shown interest in them. Trine recognised the maker's name and the potential that the shelves represented. Trine and her partner Audun had planned to buy the same shelving system for the house that they had moved into earlier in the spring. They decided that buying the shelves new was not an option because they were too expensive. On the same day as the reuse zone was organised, Trine and Audun had planned to go to Ikea and buy a cheaper shelving system. When they found the shelves in the reuse zone, they cancelled the trip to Ikea and instead took home the university's unwanted shelves. Buying a shelving system in a store is usually done based on a planned layout with exact measures. The shelving system found in the reuse zone, however, represented a large puzzle, purchased for a different project. Thus, taking home these shelves meant that Audun and Trine had to spend time figuring out how these shelves could fit in their house. Their plans for the shelves had to be adapted to fit what they had found in the reuse zone. Audun later told us that the shelves required an extra 6000 NOK of investment in the pieces that were missing to get them set up in the basement. Thus, it is unclear if money was saved by taking the shelves home. On the other hand, Audun said, there were enough shelves to also cover a wardrobe in the bedroom. The meeting of needs, in this case, was impressive. The reuse zone placed the shelves where they were needed on exactly the right day.

Reused or second-hand objects do not always fit the context where they are intended to be used. When objects lose the value from their original use context they do not always easily acquire new value in the hands of new users. They are heterogeneous and exist outside universal and more standardised forms, but by ignoring objects and not taking the time to care we run the risk of continuing the production of new objects and of GHG emissions. Without "adaptation, tinkering, fine-tuning, and repair" (Arora et al. 2020: 251) an object will remain unwanted rubbish. Trine and Audun were enthusiastic when they found their preferred shelving system but adapting the shelves to their home required work. This was work that they happily took on themselves. Tinkering encourages the adaption of practices and objects to suit needs that are complex and continually shifting (Mol et al. 2010). Without care the need for extra parts and their lack of an easy fit, could have meant that the shelves were again defined as unwanted.

The treasure hunt

Care is not necessarily an easy or simple option. Reuse also requires work, whether it is tinkering to make something fit in its new location or engaging in new practices to find what is needed. Clarke (2001) tells us that a typical strategy for dealing with the



heterogeneity of a jumble sale or nearly new sale is to circulate at least half a dozen times around the stalls before identifying the key areas of interest. This strategy was applied by a student who turned up early to the third and last reuse zone. He was with a group of students who had a lecture in an auditorium close by. He spent some time looking for something to fit his needs before the lecture but only struck lucky when he took another look after the lecture was over. Then we heard him shout to his friends "I found a cable!!" at the same time as he lifted the cable triumphantly above his head. Later in the morning, when he went to the study room where other students were working, he showed them the cable and recommended that they also visit the reuse zone. In this way, he shared the joy he had experienced during his treasure hunt. We know this because we met one of his fellow students in the afternoon in the reuse zone.

A mathematics student had a similarly joyous experience when he entered the reuse zone and spotted two blackboards stacked against the wall. Having a blackboard in his own home had been on his wish list for a long time. He told us that it was a great tool for mathematicians. Not long after he left with one of the blackboards another math student approached the reuse zone and asked if this was the place where he could get a blackboard for free. He grabbed the last one and told us that all his flat mates were mathematicians, and that the blackboard was to be put up on the wall in their apartment and shared with his flat mates. During the next half hour, several math students stopped by, confirming that the rumour of free blackboards had spread. Their disappointment about being too late was obvious.

During the three days, we observed several people visiting the reuse zones texting and calling their colleagues or friends to inform them about available items. Many of them did not take home anything themselves but were still obviously inspired to help others to meet their needs.

Caring in an environment of second-hand objects means solidarity and collectiveness despite differences (Arora et al. 2020). It also means sharing the burden by active caring (Lucas-Healey et al. 2022). In this case it meant learning new practices and encouraging others to support and participate. The cable came out of a box of miscellaneous cables, computer mice, and unidentified mixed computer stuff that we found in our department copy room. When one colleague suggested that we put the box in the reuse zone, another asked, "Will anyone want this?" We decided to give the box a chance and the meeting of needs was thereby enabled. The incident highlights the lack of hierarchy in the world of second-hand goods. What our colleagues considered rubbish, was the student's treasure. The blackboard, which might be seen by many as an outdated technology, is still perceived as a useful tool by mathematicians.

The student interested in cables and the math students did not care about the age of the objects or the context in which they were

found. Solidarity with the objects is part of the stories about cables and blackboards, but they are also about the sharing of joy and connecting new students to caring practices represented by the reuse zones. Solidarity and collectiveness despite differences and the active approach were also expressed through people's wish to match their friends and colleagues with items that they did not have any interest in themselves. This can be understood as caring for both objects and people.

Caring for the future of things

Caring practices are often unaccounted for, despite their importance for maintaining wellbeing (Martin et al. 2015). Giving and receiving care, if it is to become established and be meaningful practice, is not something that we should do alone. The two final stories include the technical staff from the Property Division. Lars, our designated driver, came and went throughout the three days and was constantly searching for more objects to fill the reuse zones. He listened to our needs - If we lacked office chairs, he found more chairs. He also spread the word, encouraging his colleagues to find us more unwanted inventory, and to join in with an activity which Lars believed was "the most important thing NTNU has ever done." Lars was conscious of fighting for unwanted objects. He has transported inventory around the university for a number (unspecified) of years and has seen many useful objects being thrown away. Lars has also heard colleagues talk about their frustration when they tried to save things from destruction. Being part of activities to test the interest among students and employees for the reuse of university inventory met a need. It gave Lars the opportunity to show that caring for the objects, for the university and for the environment was part of his job. He no longer felt alone in caring about what happens to things people do not want, he had become part of something that was attempting to change a university practice.

Lars was not alone in wanting to do more. During the second day of the reuse zone, a couple of janitors working in the building where the reuse zone was located showed up. They wondered if we were interested in more objects because they had some old office furniture in storage that was taking up space. We gladly accepted the furniture. Throughout the rest of the day, the janitors stopped by regularly to check on how "their" items were doing. They were very pleased to see that most of them were picked up quickly, confirming that they were not just happy to get rid of stuff, they cared for the old furniture. Experiencing that the objects were appreciated by others made them feel good and part of something that was attempting to change practices that they, in a similar way to Lars, were struggling with.

Care is vulnerable because it depends on others (Martin et al. 2015). Practicing care takes place within a network of interdependencies that make it possible for us to be part of the world (Puig de la Bellacasa 2011). Practicing care alone is a challenge, but Lars and the janitors were not alone in wanting to raise awareness about the problem of unwanted inventory and in the desire to change university practice. Our six experts from the Property Division



felt similarly, but the group also felt small and isolated. During a meeting where we evaluated the results from the experiments, they told us that the idea that what is old or damaged has no value is strong in the Property Division, but they wanted to change this. Godin and Langlois (2021) propose that if caring is prioritised by society, there is a chance that its position will be strengthened. Our team of experts believed that the experiments and activities

that were part of the living lab would help them to highlight the need to change practices at the university and to establish a wider caring solidarity first and foremost among their colleagues, but also further up in the university hierarchy. Our experts from the Property Division also believed that there was a future for reuse zones at the university.

Discussion

Among the challenges of moving towards more 'circular' practices is overcoming the desire for newness. Perceptions of an object's obsolescence are social and cultural drivers for exchanging one product with a newer and allegedly better one, which was identified in an extensive study of mobile phone replacement, repair, and reuse in Austria (Wieser & Tröger 2018). Objects that could have a long life, like mobile phones, chairs, or computer screens, become transient objects and end up being categorised as rubbish (Thompson 2017). This emphasis on newness and procurement within the university system has resulted in a large number of objects losing their place within the socio-technical system, becoming unwanted and uncared for.

Universities can be seen as representing a hierarchical and centralised structure, with top-down planning and reduced local autonomy for departments, employees, and students, that can limit the ability to make choices outside the system (Martin 2016). In our case, the opportunity to choose to reuse inventory rather than procuring new objects. Reused objects are heterogeneous and diverse, rather than universal and standardised (Arora et al. 2020), and as such are not currently prioritised by the university's procurement procedures. Through experiments in the context of a living lab, we found that reuse, in strong contrast to centralised administrative provision of furniture and equipment, encourages caring practices. The experiments broke down the dominant idea that university fixtures and fittings should have a homogeneous and standardised character. Experiments also provoked enthusiasm for previously unwanted objects and offered opportunities for new caring relationships. The living lab provided a space for people and objects, and their different needs to meet. Through interviews and experimentation, we found that there is widespread acceptance of the reuse of university inventory among employees and students. Participating in reuse provokes a mixture of rational and emotional responses that indicate a widespread critique of the lack of care for things and the environment.

The response to the objects in the three reuse zones showed that people are more than willing to engage with objects that have been used and discarded by others. Sustainable consumption is often dependent on relationships (Godin & Langlois 2021) and the objects from the reuse zones were often intended to be shared with others. Fisher and Tronto (1990) suggest that the knowledge, skills, and the capacity to organise resources involved in caring

processes are developed and shared in collective contexts. By sharing the objects, visitors to the reuse zones are also sharing their interest in reuse practices with others.

Care in this context means making room for things that do not fit and are not standardised. Caring can take place between objects and people, allowing for differences and new kinds of relationships that are not hierarchical and pre-defined. In this way avoiding pre-established ideas (dichotomies) that new is best and old is bad and should be thrown away. The idea of care also draws attention to 'Who cares?' 'What for?' 'Why do 'we' care?', and importantly, 'How to care?' (Puig de la Bellacasa, 2011: 96; Martin et al., 2015: 626, Linden & Lidahl 2021: 5). The three stories presented highlight three different aspects of care: the need for tinkering in the performance of care, that caring is performed in the mode of sharing, and the paramount importance of professionals.

Trine and Audun's story shows how crucial tinkering is for the re-valuation of de-valued objects. Being discarded involves being removed from a previous context of use - both literally and in a symbolic sense. The object had a function before, but now only traces of the functions and related meanings remain. The traces from previous uses, then, are likely to become limiting aspects - e.g., in the shape of a worn-out hinge or the need to hide scratches. These limitations are likely to increase the need for tinkering. Trine and Audun invested quite a lot of time into caring for the shelves. They might have saved time by buying the shelves in its new form, but they seemed to enjoy the tinkering in its own right.

In the case of the cables and blackboards, we have encountered another aspect of care, which was related to its communal performance. A focus on sharing instead of competing and selling in a market (Price 1975) was inscribed into the fundamental frame of the experiment. The things on offer were not only decontextualised from their previous use but also "worthless" in the sense that they were not valued in terms of an expected demand. Instead, the objects were shared by the university with its students and employees without expecting any reciprocal activity. As the stories surrounding cables and blackboards show, the sharing continued in how the recipients' shared information about the objects on offer with their friends and colleagues. Re-valuing the object by sharing becomes a common effort in which the matchmaking happens alongside others.



The story of the driver Lars and the janitors was presented above as illustration for the need for collaboration and mutual help in the performance of care. Without their help, the experiment would have been impossible, they were the ones who knew where to find the objects that were given away. Their strong engagement demonstrates that they perceived this work as valuable and meaningful. They preferred performing the care work that took place in and around the reuse zones, rather than their more common participation in practices of waste disposal.

The team of experts from the Property Division even believed that the experimental actions were a success that is worth repeating. The experiments increased the reuse of objects on campus, made existing reuse practices at NTNU more visible and raised awareness among students and employees about the need for them. As a result, new temporary reuse zones were planned,

but new zones and increasing sustainable circular practices at the university require resources, in the form of more people and space, and this will require economic investment. How the Property Division will gain access to the resources necessary to enable them to continue to do what they all consider important work is yet unknown. Establishing caring practices within a large organisation is a vulnerable position. Interconnectedness and dependency characterise care. One team of six enthusiasts in the Property Division is vulnerable and perhaps not enough to make the widespread changes necessary. There is the danger that they will lose their enthusiasm if no one from the university leadership or administration cares enough to offer support. Giving care also depends on the availability of resources, and who makes them available (Godin and Langlois 2021). The lack of resources can influence opportunities for developing and nurturing circular practices.

Conclusions

The caring practices uncovered through living lab activities could be useful in efforts to reduce consumption and achieve sustainability ambitions in universities. Universities are centres for the research and education that is necessary to enable society wide communication of the challenges and solutions to reducing GHG emissions and sustainable transitions. With this role comes the responsibility to make structural changes in the university organisation to follow-up the goals set by the Paris agreement to reduce greenhouse gas emissions. NTNU has stated that the Gløshaugen campus is to be a zero-emission campus, but recent state budget cuts threaten these ambitions.⁷ There is little money for renewable energy production, ambitious energy saving systems, or even the recycling of building materials. We propose that the challenges this implies for the technical solutions to a sustainable campus offers an opportunity for the resource efficient low-tech ambitions found in reusing university inventory. Ambitions that in addition to reducing the production of GHG emissions also promote a more caring and inclusive approach to the sustainable future. The numerous small scale heterogeneous actions that care requires engages effectively with the challenges of achieving sustainability transitions and is an alternative to universal techno-centric solutions about energy efficiency often promoted by the University. Technical solutions that take the actions to reduce GHG emissions out of the hands of citizens and place them under the control of experts and technologies (Ellesworth-Krebs et al. 2015).

By taking objects from the reuse zones in the living lab, people were also participating in circular consumption practices that say something about their expectations toward the university. A university that introduces new circular practices can avoid “Armageddon” and receive support from its students and employees. A convivial university offers a caring circular-economic context that supports its employees and students in actions that are autonomous, diverse, adapted to the context, rather than standardising in their efforts to achieve sustainability. The democratic politics of social-environmental activism and public policy are essential to such a process (Arora et al. 2020). We propose that modest acts such as reusing objects could also help to steer large organisations like universities towards a more caring and sustainable future.

Care emphasises a long-term commitment, which is largely what the circular economy is about, i.e., extending product lifetime. The more mainstream sustainability efforts centre around strategies of efficiency and product substitution (new objects), which is necessary for the continued value creation within a growth-based and technocratic paradigm. A convivial approach to sustainability opens different avenues for engaging more personally with objects, which is required to reduce the need for newness and enable an extension of a products lifetime. Our contribution emphasises how a shift to more circular forms of organisation in universities can be achieved, and how engaging students and employees can facilitate and promote care practices.

⁷ <https://www.universitetsavisa.no/anne-borg-campusprosjektet-ola-borten-moe/ola-borten-moe-varsler-kutt-i-campusprosjektet-pa-mange-millarder-kroner/360172>



Acknowledgements

This research was funded by the FME Research Centre on Zero Emission Neighbourhoods in Smart Cities (FME ZEN) <https://fmezen.no/>

Author description

Dr. Ruth Woods is a research scientist at the department of Interdisciplinary Studies of Culture, NTNU. She has a background from fine art, anthropology, and architecture. Research interests include housing and homelife, buildings and technology, and sustainability transitions.

Thomas Berker is professor in Science and Technology Studies at NTNU's Centre for Technology and Society. He has published extensively on technology end-use, sustainability, and - more recently - on questions related to bottom-up infrastructuring.

Dr. Thomas Edward Sutcliffe is a social scientist in the interdisciplinary field of Science and Technology Studies (STS) and works as a researcher at the Norwegian Institute for Nature Research. His research interests encompass studies of consumption, including a particular focus on the practices and politics of the circular economy. Currently, he researches issues of governance at the junction of biodiversity and climate change, ecosystem restoration, the role of knowledge, and effects of land use and land-cover change.

Hanne Marit Henriksen is a PhD student at the Department of Interdisciplinary Studies of Culture at NTNU. Her research interests include science communication and user engagement.

References

- Arora, S., Van Dyck, B., Sharma, D., Stirling, A. (2020) Control, care, and conviviality in the politics of technology for sustainability, *Sustainability: Science, Practice and Policy*, 16:1, 247-262. <https://doi.org/10.1080/15487733.2020.1816687>
- Bimpizas-Pinis, M., Bozhinovska, E., Genovese, A., Lowe, B., Pansera, M., Alberich, J. P., & Ramezankhani, M. J. (2021) Is efficiency enough for circular economy? *Resources, Conservation and Recycling*, 167, 105399. <https://doi.org/https://doi.org/10.1016/j.resconrec.2021.105399>
- Bugallo-Rodríguez, A., & Vega-Marcote, P. (2020) Circular economy, sustainability and teacher training in a higher education institution. *International Journal of Sustainability in Higher Education*, 21(7), 1351-1366. <https://doi.org/10.1108/IJSHE-02-2020-0049>
- Bulkeley, H. and Castan Broto, V. (2013) 'Government by experiment? Global cities and the governing of climate change.', *Transactions of the Institute of British Geographers.*, 38 (3). pp. 361-375.
- Clarke, A.J., (2001) *The Practice of the Normative: the Making of Mothers, Children and Homes in north London*. PhD thesis. UNIVERSITY COLLEGE, LONDON.
- Energy Performance of Buildings Centre (2021) The Energy Performance of Buildings Directive (EPBD) — EPB Standards — EPB Center | EPB Standards. Energy Performance of Buildings Center. <https://epb.center/epb-standards/energy-performance-buildings-directive-epbd/>
- Ellsworth-Krebs, K., L. Reid, Hunter, C. (2015) "Home-Ing in on Domestic Energy Research: "House", "Home", and the Importance of Ontology," *Energy Research & Social Science* 6: 100-108.
- EU-COM (2020) In focus: Energy efficiency in buildings. (Accessed 21 January 2024) https://commission.europa.eu/news/focus-energy-efficiency-buildings-2020-02-17_en
- European Commission. (2015). Closing the loop - An EU action plan for the Circular Economy. https://eur-lex.europa.eu/resource.html?uri=cellar:8a8ef5e8-99a0-11e5-b3b7-01aa75ed71a1.0005.02/DOC_1&format=PDF (Accessed 26 June 2024)
- European Commission. (2020). A new Circular Economy Action Plan For a cleaner and more competitive Europe. https://ec.europa.eu/environment/pdf/circular-economy/new_circular_economy_action_plan.pdf (Accessed 26 June 2024)
- European Commission (2023) Circular economy: definition, importance and benefits <https://www.europarl.europa.eu/topics/en/article/20151201/STO05603/circular-economy-definition-importance-and-benefits> (Accessed 10 June 2024)
- Evans, D. (2011) Consuming conventions: sustainable consumption, ecological citizenship and the worlds of worth. *Journal of Rural Studies* 27 (2), 109-115. <https://doi.org/10.1016/j.jrurstud.2011.02.002>
- Fisher, B. and Tronto, J.C. (1990) Towards a feminist theory of caring, in K. Abel and M.K. Nelson (eds) *Circles of Care: Work and Identity in Women's Lives*, Albany, NY: State University of New York Press, pp 35-62
- Forrest, A., Hilton, M., Ballinger, A., Whittaker, D. (2017) Circular Economy Opportunities in the Furniture Sector. European



- Environmental Bureau (EEB) URL: <file:///C:/Users/giuli/Desktop/Circular-Economy-in-the-Furniture-Sector.pdf>. (Accessed 02 January 2023).
- Geertz, C, Geertz, H & Rosen, L. (eds.) (1979) *Meaning and Order in Moroccan Society*. Cambridge: Cambridge University Press.
- Genovese, A. and Pansera, M. (2021) 'The Circular Economy at a Crossroads: Technocratic Eco-Modernism or Convivial Technology for Social Revolution?'. *Capitalism Nature Socialism*, 32(2), pp. 95–113.
<https://doi.org/10.1080/10455752.2020.1763414>
- Giddens, A. (2008) Modernity and self-identity: self and society in the late modern age, in S. Seidman and J.C. Alexander (eds) *The New Social Theory Reader*, London: Routledge, pp 354–61.
- Godin, L., Langlois, J. (2021) Care, Gender, and Change in the Study of Sustainable Consumption: A Critical Review of the Literature. *Front. Sustain.*, 02 November 2021 Sec. Sustainable Consumption Volume 2 - 2021
<https://doi.org/10.3389/frsus.2021.725753>
- Hoxha, E., Jusselme, T., (2017) On the necessity of improving the environmental impacts of furniture and appliances in net-zero energy buildings. *Science of the Total Environment* 596-597, 405–416. doi:10.1016/j.scitotenv.2017.03.107.
- Illich, I. 1973. *Tools for conviviality*. Harper & Row, New York.
- Janda, K. B., Topouzi, M. (2015) Telling tales: using stories to remake energy policy. *Building Research & Information*, 43:4, 516-533, DOI: 10.1080/09613218.2015.1020217
- Jasanoff, S. (2018) Just transitions: A humble approach to global energy futures. *Energy Research & Social Science* Volume 35, January 2018, Pages 11-14.
<https://doi.org/10.1016/j.erss.2017.11.025>
- Kleinman, A., & Van Der Geest, S. (2009). 'Care' in health care. *Medische Anthropologie*, 21(1), 159-168.
- Lauvland, H.J. (2021) The Carbon Footprint of Furniture. Master's thesis in Energy and Environmental engineering. Norwegian University of Science and Technology.
<https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2779677>
- Linden, S. & Lydahl, D. (2021) Editorial: Care in STS. *NJSTS* vol 9 issue 1 2021.
<https://doi.org/10.5324/njsts.v9i1.4000>
- Lucas-Healey, K., Ransan-Cooper, H., Temby, H., Russell, A. W. (2022). Who cares? How care practices uphold the decentralised energy order. *Buildings and Cities*, 3(1), pp. 448–463.
DOI: <https://doi.org/10.5334/bc.219>
- Maitre-Ekern, E. (2021) Re-thinking producer responsibility for a sustainable circular economy from extended producer responsibility to pre-market producer responsibility. *Journal of Cleaner Production*, 286, 125454.
<https://doi.org/10.1016/j.jclepro.2020.125454>
- Martin, A., Myers, N., Viseu, A. (2015) The politics of care in technoscience. *Social Studies of Science* 2015, Vol. 45(5) 625–641. DOI: 10.1177/0306312715602073
- Martin, B. (2016) What's happening to our universities? *Prometheus*, 2016 Vol. 34, No. 1, 7–24
<http://dx.doi.org/10.1080/08109028.2016.1222123>
- Mendoza, J. M. F., Gallego-Schmid, A., & Azapagic, A. (2019). Building a business case for implementation of a circular economy in higher education institutions. *Journal of Cleaner Production*, 220, 553-567.
<https://doi.org/10.1016/j.jclepro.2019.02.045>
- The Ministries. (2021) Nasjonal strategi for ein grøn, sirkulær økonomi [A national strategy for a green, circular economy]. The Ministries.
<https://www.regjeringen.no/no/dokumenter/nasjonale-strategi-for-ein-gron-sirkular-okonomi/id2861253/> (Accessed 6 March 2023)
- Mol, A, Moser, I., Pols, J. (2010) Care: putting practice into theory (In) Mol, A, Moser, I., Pols, J. (eds.) *Care in Practice: On Tinkering in Clinics, Homes and Farms*. (eds.) May 2010, 326 p., ISBN 978-3-8376-1447-3
- Norges Tekniske Naturvitenskapelig Universitet (2019) Miljørapport for NTNU 2019.
https://www.ntnu.no/documents/10137/0/Milj%C3%B8rapport+2019_6.pdf/83c78177-0505-944f-067f-283fe232463c?t=1590667763455 (Accessed June 13th 2024).
- Price, J. A. (1975) "Sharing: The Integration of Intimate Economies." *Anthropologica* 17(1): 3–27. doi:10.2307/25604933.
- Puig de la Bellacasa, M. (2011). Matters of care in technoscience: Assembling neglected things. *Social Studies of Science*, 41(1), 85-106.
<https://doi.org/10.1177/0306312710380301>
- Schliwa, G., & McCormick, K. (2016). Living labs: Users, citizens and transitions. In *The experimental city* (pp. 163-178). Routledge.
<https://www.taylorfrancis.com/chapters/edit/10.4324/9781315719825-15/living-labs-gabriele-schliwa-kes-mccormick>
- Sengers, F., Berkhout, F., Wiczorek, A.J., Raven, R. (2016) Experimenting in the City: unpacking notions of experimentation for sustainability. In Evans, J., Karvonen, A., Raven, R. (Ed.) *The Experimental City*. London. Routledge.
- Serrano-Bedia, A., Perez-Perez, M. (2022) Transition towards a circular economy: A review of the role of higher education as a key supporting stakeholder in Web of Science, Sustainable Production and Consumption, Volume 31, 2022, Pages 82-96,
<https://doi.org/10.1016/j.spc.2022.02.001>
- Skaar, C., Solli, C., Vevatne, J. (2019) Designing a ZEN Campus: An exploration of ambition levels and system boundaries. *IOP Conf. Ser.: Earth Environ. Sci.* 352 012025. doi:10.1088/1755-1315/352/1/012025.
- Stahel, W. R. (2016) The circular economy. *Nature*, 531(7595), 435-438.
<https://doi.org/10.1038/531435a>
- Steen, K., & van Bueren, E. (2017) The Defining Characteristics of Urban Living Labs. *Technology 39 Innovation Management Review*, 7(7): 21–33.
<http://timreview.ca/article/108>
- Stirling, A. (2015) Emancipating Transformations: From controlling 'the transition' to culturing plural radical progress 1. In *The politics of green transformations* (pp. 54-67). Routledge.
- Syse, K., Mueller, M. (2015) "Introduction." In *Sustainable Consumption and the Good Life: Interdisciplinary Perspectives*, edited by K. Syse and M. Mueller, 1 € –6. London: Routledge.
- Wieser, H., & Tröger, N. (2018) Exploring the inner loops of the circular



- economy: Replacement, repair, and reuse of mobile phones in Austria. *Journal of Cleaner Production*, 172, 3042-3055.
<https://doi.org/10.1016/j.jclepro.2017.11.106>
- Woods, R., Baer, D., Berker, T., Bø, L.A. (2019) ZEN LIVING LABS Definition, Ideas and Examples. SINTEF akademisk forlag.
- Woods, R. & Berker, T. (2019) Living labs in a zero emission neighbourhood context. IOP Conf. Ser.: Earth Environ. Sci. 352 012004
- Woods, R. & Berker, T. (2020) Citizen participation in Steinkjer: Stories about the "old NRK building at Lø" IOP Conf. Ser.: Earth Environ. Sci. 588 032016
- Woods, R., & Berker, T. (2021) Norwegian pilots: Navigating the technological logic of sustainable architecture. In Stender, M., Bech-Danielson, C., Hagen, A.L., (Ed.) *Architectural Anthropology: Exploring Lived Space*. Routledge. ISBN 9780367555757