Capturing the micro-level of intermediation in transitions: Comparing ethnographic and interview methods

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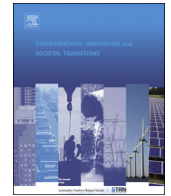Sustainable Lifestyles 2.0: End User Integration, Innovation and Entrepreneurship (EU-InnovatE) View project

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Original Research Paper

Capturing the micro-level of intermediation in transitions: Comparing ethnographic and interview methods

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ABSTRACT

To date, a major portion of sustainability transition research has relied on retrospective methods to generate encompassing macro-level views of transitions. However, such methods may have considerable impacts on the insights generated in the study of intermediation, action and agency by actors on the micro-level of transitions. In this article, we compare retrospective interviews and real-time ethnography to understand how they portray micro-level transition processes and intermediation. The empirical context of our study is energy retrofitting, which we use to illustrate three structural and three process aspects that distinguish the findings from retrospective interviewing and real-time ethnography. Ethnographic methods can provide significant new detail on the uncertainty and complexity of micro-level transition processes while interviews facilitate cross-case comparison and understanding of commonalities in micro-level transition intermediation processes better.

1. Introduction

Sustainability transitions aimed at moving to more sustainable modes of production and consumption are broad phenomena. They therefore require an equally broad methodological basis to understand developments in a variety of interrelated factors such as technology, policy, culture and demand (Kemp et al., 1998). As such, methods for studying sustainability transitions must capture not only the macro-level of policy and systems but also to the micro-level of communities' and individuals' daily lives and practices where the changes to consumption patterns occur. Here, transition research is concerned with capturing the change of everyday practices into more sustainable ones, particularly by committing to major changes in local sociotechnical configurations (e.g. Shove and Walker, 2007, 2010; Rinkinen and Jalas, 2017).

As a part of the study of such changes, transition research methods must cater to an understanding of how intermediaries and intermediation activities shape emerging transitions (Geels and Deuten, 2006; Kivimaa et al., 2019a; Hyysalo et al., 2018). Intermediaries have been found to contribute to transitions in a wide range of ways through, for example, creating and brokering networks, translating and negotiating, capacity building and the creation of an evidence base to support transition alternatives (Klerkx et al., 2009; Kivimaa, 2014; Bush et al., 2017; Hyysalo et al., 2018; Smith et al., 2016). Intermediaries also come in many forms. For example, intermediaries may be specifically set up to promote transitions (Kivimaa et al., 2019a) or they may emerge from small-scale citizen-led activities (Hyysalo et al., 2018). Intermediation activities may range from promoting and legitimizing transitions (Kivimaa et al., 2019b) to configuring technology for specific sites and contexts (Stewart and Hyysalo, 2008). Intermediation

activities and the roles that intermediaries play in transitions are not static, but instead subject to change during transitions (Hyysalo et al., 2018; Kivimaa et al., 2019b). Thus, methods used for studying intermediaries in transitions must be capable of recording dynamic events on various levels of granularity and scope.

However, to date, the recognition of the plurality and variety of intermediary activities and actors has not duly translated into a variety of research methods and research designs used to generate insight into them. The great majority of transition research has progressed via interviews and document analyses, particularly retrospective expert interviews, probably because the wide scope and long timespans of transitions have pushed scholars to seek encompassing views (Zolfagharian et al., 2019). Such methods may, however, have considerable shortcomings in the study of intermediation, action and agency by actors on the micro-level of transitions, where individuals, households and citizen communities engage with transition agendas in the present. Indeed, it is generally known that sociotechnical phenomena can display themselves differently in real time and when studied retrospectively (e.g. Hyysalo et al., 2019; Latour, 1987; Höyssä and Hyysalo, 2009; Garud and Gehman, 2012). It is similarly known that ethnographic studies can reveal different and greater detail and new patterns of real-time sociotechnical phenomena that tend to remain invisible in interview studies (e.g. McLaughlin et al., 1999; Szymanski and Whalen, 2011; Hyysalo et al., 2019). Hence, real-time ethnographic approaches have been proposed as a relevant methodological option (Köhler et al., 2019) for understanding micro-level transition processes, their initiation, and how intermediaries support and operate in those processes. Previous studies have addressed energy retrofitting (Murto et al., 2019a), renewables acquisition and adaptations (Hyysalo et al., 2013, 2018) and electric vehicle purchasing (Zarazua de Rubens et al., 2018), but with limited discussion into the benefits of using ethnographic approaches. The relative merits and drawbacks of real-time observational studies in the study of intermediation in sustainability transitions may therefore require clarification (Zolfagharian et al., 2019).

In this article, we compare retrospective interviews and real-time ethnographic participant observation to display how the use of research methods impacts on the portrayal of intermediation in sustainability transitions. The comparison is motivated by the centrality of retrospective interviews as research method in transitions research – interviews are used widely and confidently to cover transition related phenomena, sometimes seemingly unaware of the alternatives and the limitations to interviews – and the relatively scant discussion on what real-time ethnographic methods can offer for the study of transitions related phenomena. By doing so, we contribute to the discussion on transition research methods and data to further strengthen the ability of sustainability transition research to support and stimulate current transition processes (Zolfagharian et al., 2019; Markard et al., 2012; Köhler et al., 2019). Against this backdrop our guiding research question is: what differences and potential benefits and drawbacks does real-time ethnographic observation have compared to interviews in the study of transition technology adoption processes and the related user and process intermediation at the micro-level?

The empirical context of our comparison is energy retrofitting and the Finnish energy retrofit market. In general, energy retrofits aim to improve energy efficiency and/or switch to less resource-intensive energy production methods (De Boeck et al., 2015; Matschoss et al., 2013; Brown, 2018; Wilson et al., 2015). As such, energy retrofits are micro-level events where retrofit adopters perform activities and practices that drive transitions forward and serve as building blocks for systemic and long transitions (Sovacool, 2016; Shove and Walker, 2010; Vasileiadou and Safarzyńska, 2010; Smith et al., 2005; Pesch, 2015). Such micro-level events may be short and seemingly insignificant in the grand scheme of the transition but it is where the proverbial 'rubber' meets the transition 'road' and through which the transition progresses. This is particularly so in the acceleration and stabilization phases of transitions, where the transition is expected to gain momentum through increasing adoption rates for more sustainable technologies and no longer remain limited to experiments, pilots and early adopters (Köhler et al. 2016). Thus, energy retrofits are a well-suited phenomenon for bringing to the fore timely methodological issues of sustainability transition research (Zolfagharian et al., 2019; Köhler et al., 2019).

In the next section, we discuss the potential contributions of real-time ethnographic approaches in studying sustainability transitions, particularly in understanding adopters and the intermediaries associated with them (note: we do not discuss interview methods in similar detail as they are the dominant research methods in transition studies and familiar to the readership). Then, we present a comparison of what issues different methods reveal and outline their relevance in the sustainability transition research context.

2. Capturing agency and intermediation in transitions

2.1. Retrospective and real-time ethnographic methods in transition research

Research aimed at understanding sustainability transitions and their constitutive phenomena has traditionally focused on how major technological and societal change unfolds over time (Geels, 2002; Geels and Schot, 2007; Markard et al., 2012; Köhler et al., 2019). Given such foci, sustainability transition research has built heavily on longitudinal system-level case studies (Markard et al., 2012; Zolfagharian et al., 2019). However, the dominance of such research designs has raised concerns over how well current transition models and methods account for the micro-level and everyday practices that shape transitions at the system level (Zolfagharian et al., 2019; Svensson and Nikoleris, 2018; Shove and Walker, 2007, 2010; Smith et al., 2005; Berkhout et al., 2004; Genus and Coles, 2008; Vasileiadou and Safarzyńska, 2010; Hyysalo et al., 2018). Zolfagharian et al. (2019, p. 11) put it well: 'in addition to analyzing the systemic nature of transition processes, one needs to study the interactions and associations of sub-systems and social groups which shape overall emergent patterns and behaviors at the systems level'.

A helpful way to align the discussion on how differences in method influence differences in research insights is to pinpoint what issues may become revealed (or remain hidden) depending on the choice of methods. The use of real-time ethnographic methods is

generally beneficial for collecting first-hand data on phenomena and potentially revealing previously hidden issues (Silverman, 2011). It is commonly known that the use of retrospective and secondary data – such as documents and archives – can 'gloss over conflict and complexity' (Bizzi and Langley, 2012, p. 229), while interviews are sometimes specifically used for making complex phenomena more accessible for research by tapping into the sensemaking of those participating in the processes (Bizzi and Langley, 2012; Yin, 2009). Hence, the value of real-time ethnographic methods in sustainability transition research can be similarly expected to hinge on their ability to provide detail and reveal issues that would remain hidden in studies using other methods (on its limitations, see Section 2.2 below).

What are then the details and hidden issues that could be revealed through ethnographic sustainability transition research? Real-time ethnographic methods are specifically relevant in revealing uncertainties present at the moment, actors' perspectives beyond hindsight rationalizations, the structure of action and the agency of actors (Suchman, 1987; Bijker, 1995; Szymanski and Whalen, 2011; Hyysalo et al., 2019). Ethnographic methods are particularly apt for exploring how market structures and intermediaries support (or how they otherwise affect) the acquisition processes of transition-related technologies at the micro-level, such as sustainable energy technologies (Hyysalo et al., 2013; Heiskanen et al., 2014; Murto et al., 2019a) or electric vehicles (Zarazua de Rubens et al., 2018). In practice, the market availability of transition-related technologies and support from intermediaries may be insufficient or difficult to attain for reasons that are difficult to detail using documents or interviews (Murto et al., 2019a,b; Zarazua de Rubens et al., 2018).

In close relation to agency, real-time ethnographic approaches are expected to reveal better the complexity and uncertainty of user action at the micro-level of sustainability transitions (Köhler et al., 2019; Hyysalo et al., 2018; Zarazua de Rubens et al., 2018; Murto et al., 2019a). Complex processes rarely possess the kind of clarity that retrospective reports may lead us to assume is in place (Garud et al., 2010; Höyssä and Hyysalo, 2009), and hence may easily unduly simplify complex processes such as micro-level transition activities. For example, Latour's (1987) case studies emphasize how different scientific work and technology development look depending on the temporal perspective of the study; during development, there is little or no certainty on the right course of action and the only way out is through development and learning about what works and what does not. Indeed, just as sociotechnical configurations in transitions shift from those that might work to those that work (Berkhout et al., 2004), adopters of transition-related technology at the micro-level must go through an uncertain process in regard to knowing what to buy, from whom and how, and knowing what may be the consequences of adoption – in other words, there is uncertainty in defining what will work.

Real-time ethnographic methods have further relevance for uncovering and directly observing the work of intermediaries that operate close to the adopters. Such user intermediaries and the related process intermediaries (Kivimaa et al., 2019a, 2019b) are typically more difficult to observe in research given their (potential) lack of structure and formality in comparison to supply-side intermediaries (Stewart and Hyysalo, 2008). Hence, user-side intermediaries and intermediation may be particularly poorly revealed unless they are directly studied from the perspective of adopters. Just as importantly, the adopter-side intermediation processes and market mechanisms tend to be assumed to be functioning well by more distanced informants such as domain experts even when this is not the case. In this, real-time ethnographic methods have the further advantage of increasing the detail level of intermediaries and their relevance in micro-level processes. In the overall sustainability transition context, this is specifically important because of the central role of intermediaries in transition processes (see, e.g. Kivimaa et al., 2019b; Hyysalo et al., 2018; Bush et al., 2017; Geels and Schot, 2007).

2.2. The characteristics of ethnographic methods for transition research

The use of ethnographic approaches in transition research has certain practical implications and limitations that researchers must account for. First, ethnographic research approaches may require considerable investment of time and effort from researchers. As such, studying entire transitions ethnographically would be particularly challenging because of the length, and uncertainty over the length, of the transition (Sovacool, 2016). Short-term studies may also face difficulties in interpreting the data vis-à-vis the emerging transition (Vasileiadou and Safarzyńska, 2010) and result in 'closure effects' that overemphasize results from narrowly framed studies (Hyysalo et al., 2019). However, not all events in a transition are long (Zolfagharian et al., 2019; Sovacool, 2016) or completely unique phenomena that occur only once during a transition (Shove and Walker, 2007). Instead, micro-level events (such as energy retrofits or electric vehicle purchases) may be short processes compared to the overarching transition, and it is their large-scale repetition that contributes, and is highly important, to a transition. Here, cross-sectional and real-time ethnographic methods may be particularly useful, especially for influencing ongoing transitions, something that has thus far been weakly addressed in transition research (Zolfagharian et al., 2019).

The second practical aspect concerns sampling, access and case definition. Retrospective interview methods give researchers considerable room for strategic manoeuvring in terms of case definition, selection and sampling. Ethnographic approaches, however, often require more upfront effort to access sites and collect data (Hammersley and Atkinson, 1995). This typically means that fewer sites tend to be (or even can be) studied (at least simultaneously) and that sampling for a wider variety of cases may be challenging if not anchored in other research methods (Hyysalo et al., 2019). The study of events in real time also means that exhaustive case definition may be unfeasible in advance, given the uncertainty associated with the course of events. However, whilst these sampling issues may be dealt with in various ways (Gobo, 2007; Hyysalo et al., 2019), they remain least cumbersome in research designs where researchers can observe and participate in the 'mundane' activities of adopters and citizens, especially when studying short and frequent transition processes (see, e.g. Zarazua de Rubens et al., 2018; Murto et al., 2019a). This is not to say that ethnographic research should only be used in easily accessible settings but rather to underline the tactics needed for adjusting ethnographic approaches to suit research designs on different scales and levels of granularity.

Third, the capturing of data through ethnography and direct observation in real time can be an overwhelming process because of the sheer amount of information available to the researcher (Hammersley and Atkinson, 1995). Whereas interviews are easily recorded and retrieved later on in the research process, real-time ethnographic observation faces a constant challenge: deciding on what to capture and how to capture it for later analysis. There is the necessary selectivity of what can be captured if photography, audio and video recording or capture of digital content is not possible, and necessary selections on the wealth of possible information if these are available. To deal with this, real-time ethnographic approaches often benefit from making explicit what issues are focused on and recorded in the data (both theoretical and practical issues)(Silverman, 2011; Hammersley and Atkinson, 1995). In transition research, this further underlines the suitability of real-time observation in the study of repetitive transition events and associated intermediation activities.

3. Methods and data

To display the relative merits of interviews and ethnographic studies in studying micro-level of transition intermediation, we draw on two datasets that have the same unit of analysis: the Finnish energy retrofit market and how to implement energy retrofits from the perspective of housing companies. Housing companies in Finland are a form of multi-owned housing where a board elected from owner-occupants plays a major role in planning renovation and maintenance projects (for an overview, see Lujanen, 2010). Housing companies have similarities with housing cooperatives, condominiums and homeowner associations found in other countries. Housing companies govern roughly half of the Finnish housing stock (Matschoss et al., 2013) and in Europe approximately 40 % of housing is multi-owned (Weatherall et al., 2018). Multi-owned housing has also been a growing form of housing tenure, especially in densifying Asia-Pacific cities (Altmann and Gabriel, 2018).

The owners of multi-owned housing assets are a relevant user group or type to study to understand micro-level transition processes. Housing is an important sector to address in mitigating climate change (e.g. De Boeck et al., 2015; Kangas et al., 2018) and is therefore a key context for research and development aimed at understanding and stimulating the energy transition. However, energy retrofit adoption has been slow in multi-owned housing (Matschoss et al., 2013). Hence, it is particularly interesting for sustainability transition research to understand why transition sub-processes may fail to accelerate and, further, whether different research methods can provide a way forward in understanding transitions at the micro-level.

Our comparison is also motivated by recent calls to pay increasing attention to the daily lives of users in sustainability transitions, especially through ethnographic methods (Köhler et al., 2019; Hyysalo et al., 2018). Given the commonality of interview data in transition research, a comparison of interviews and ethnography is well suited for illustrating differences and potential gains from ethnographic approaches in sustainability transition research. Next, we discuss our datasets and analysis in detail.

3.1. Interviews of energy retrofitting

The interview dataset consists of semi-structured interviews with 12 housing companies that have successfully implemented energy retrofits (identified as cases C1-C12). The interviews were conducted between April 2018 and October 2018 by the first author (hereinafter referred to as the fieldworker). The cases were identified through searches from social and online media and apartment sales portals (22 housing companies were contacted overall, resulting in a response rate of 55 %). Even though it is in principle entirely possible to do an interview-based study of unsuccessful or aborted retrofit adoption processes and these would have provided an important complementarity to the realized cases, no such cases were found despite attempts made to identify them. In all of the cases we did get access to, the energy retrofit had significantly changed the energy system of the property. Hence, the cases represent micro-level transition processes that yield significant environmental benefits and require considerable effort from the housing companies to implement. The interviews were carried out primarily with housing company board members, who had a key role in the energy retrofit, but they also sometimes included property managers or energy consultants. In total, 21 individuals were present in the interviews.

The interview protocol was developed by the field worker and three professors versed in energy retrofits and included questions concerning the general details of the retrofit process (e.g. initiation, acquisition process, costs, overview of the process, implemented measures and technologies) as well as intermediary-specific questions (e.g. where information and support for the project was found from and who provided it). In some cases, the interview included a tour around the housing company premises to see the installed measures and technologies in action, which provided a more situated context for discussion as well. Also additional materials were asked as part of the interviews and in a few cases presentations, retrofit calculations or comparison were presented and handed to the fieldworker. In all, the interviews sought to establish as nuanced and detailed understanding of the retrofit measures taken, the retrofit acquisition process and motives behind it, the course of the retrofit process and the roles intermediaries may have played in the process. In terms of expertise in developing an adequate interview protocol and carrying out the interviews the fieldworker had previously conducted a large interview-based study and the professors had conducted over 300 interviews related to technology use, adoption, acquisition and design in their various past projects as well as taught interview research at post-graduate and doctoral levels. The duration of the interviews ranged from $44 - 82$ min and they were all recorded and transcribed for analysis. Table 1 outlines the basic information of the housing companies studied.

3.2. Ethnography of energy retrofitting

The second dataset consists of real-time ethnographic data collected by the fieldworker over five months of active participation in

Table 1
Details of interviewed housing companies.

Identifier	Building type	Number of apartments	Number of interviewees	Measures undertaken
C1	Detached houses	5	1	GSHP
C2	Terraced house	11	1	GSHP
C3	Detached and semi- detached houses	22	1	GSHP
C4	Apartment block	36	1	GSHP + EAHR
C5	Apartment block	64	1	GSHP + EAHR
C6	Apartment block	24	2	GSHP + MAE
C7	Apartment block	36	4	GSHP + EAHR
C8	Apartment block	105	4	GSHP + EAHR + PV
C9	Apartment block	19	1	GSHP
C10	Apartment block	54	2	GSHP + EAHR + PV + ST + WWHR + insulation (various)
C11	Apartment block	23	2	GSHP + GSC
C12	Apartment block	55	1	GSHP

Abbreviations: PV = solar photovoltaics, GSC = ground source cooling, GSHP = ground source heat pump, MAE = machine exhaust ventilation, WWHR = waste water heat recovery, EAHR = exhaust air heat recovery, ST = solar thermal.

the Finnish energy retrofit market between February 2018 and June 2018, conducted mostly prior to starting the interview study. In the study, the fieldworker represented the boards of two housing companies in the Finnish capital region with the goal of finding suitable energy retrofit options for the sites: a 12-apartment block (identified as S1) and a 23-apartment terraced house split into four buildings. The fieldworker did not have specific prior knowledge of housing energy systems, and the study focused on drawing up recommendations for improving the properties' energy systems, which can be considered a natural setting for how a housing company might go about improving its energy system. Nor did the process of study follow an explicit plan: instead, recommendations and instructions from the market and intermediaries were followed as the fieldworker tried to make sense of energy retrofit technologies and the best options for S1 and S2. The fieldworker underwent the search process which a housing company board member would need to undergo if the housing company were to pursue such a retrofit process.

The work primarily consisted of acquiring information about energy retrofit opportunities in the market and finding intermediaries and other market actors to support the process. Information was sought from energy guidebooks aimed at housing companies and over 60 websites: primarily intermediary-led portals on energy, installer websites and energy discussion forums. For both sites, 20 market actors or other intermediaries were contacted with the intention of finding suitable energy retrofit measures and technologies for the sites. Some intermediaries also visited the site to generate more accurate energy retrofit proposals for the sites.

To capture the fieldwork process and data, separate field note logs were kept for both sites outlining what actions the fieldworker took on the field (i.e., persons contacted, events observed, when, for how long and how they supported the energy retrofit process). Tentative research ideas were also collected alongside the field notes to support and provide an analysis trail. In the end, the field notes came to 145 individual notes (circa 38,000 words in total).

3.3. Analysis and comparison

Our analysis has focused on the first steps of the energy retrofit: accessing the market and acquiring the energy retrofit. In analysing the differences between the methods, we departed from an overarching view that energy retrofits are micro-level transition processes during which the sociotechnical constellation of an individual property shifts to a new kind of (more sustainable) constellation, which requires action within the changing market, intermediary and supply structures (i.e. change in *sociotechnical structures over time*). Following from this, the basis of our analysis was identifying 1) what *structural aspects* of the market the different methods reveal and 2) what *process aspects* the different methods reveal.

We used two complementary strategies to provide further analytical basis for the comparison. First, we drew from extant literature on intermediaries, transitions and energy retrofitting to hypothesize what aspects might emerge as relevant during the interviews and ethnography (e.g. ecology of intermediaries, champions, process difficulties and barriers, transition stages, transition pathway types, complexity, agency). These aspects were used as sensitizing concepts and items in research instrumentation to support observations (e.g. direct questions about support in interviews and listing of actors and what they provided to the project in our ethnography field note template). Second, following from the notion that different methods reveal different aspects of phenomena, we analysed the kinds of events and activities that emerged from the data. This activity was supported by recording the time spent in our research instrumentation in both studies.

The final step of the analysis was to iteratively search for patterns and differentiating aspects in and across the datasets and match the findings with theoretical insights. Visual mapping (Langley, 1999) was an important analytical tool in this phase for illustrating differences and presenting the work between the authors and in two research seminars for feedback. As a result, our initial pool of ten differentiating aspects was reduced to six, which form the content of our results section.

Table 2

An overview of the differences between the methods.

	Visibility issue	Ethnographic participant observation	Interviews
Structural aspects	Project champions and championing intermediaries	- The identification of champions and intermediaries is ongoing; there is no certainty regarding who could be a championing intermediary	- Champions are salient and important figures in retrofit process narratives
	The energy retrofit market and ecology of intermediaries	- The market, intermediaries and dynamics are directly observable with a fine and potentially cumbersome level of detail	- The market is embedded in past actions and focuses on key figures with a coarse level of detail
	Complexity	- Complexity is a constant issue that needs to be faced time and again	- Complexity is associated with specific events and has been contained and dealt with
Process aspects	The requirements of energy retrofit market entry and acquisition	- The difficulty and slowness of market entry is visible and open for detailed analysis	- Market entry and acquisition as a starting point of the overall process narrative; a low level of detail
	Alternative paths	- Different retrofit options as equally interesting paths to pursue; re-directing, dead-ends and learning characterise the process	- The retrofit process as a singular path where different retrofit options have become 'losing choices'
	What leads to successful outcomes	- Uncertainty over whether the taken actions will lead to a successful energy retrofit	- Projects are known to have been successful; the possibility to draw conclusions about common success factors (in principle)

4. Results

In this section, we outline the differences between the methods employed in our dual study. We outline six differentiating visibility aspects between the methods, of which three concern sociotechnical structures:

- The visibility of project champions and championing intermediaries
- The visibility of the energy retrofit market and ecology of intermediaries
- The visibility of complexity

Three of our aspects concern the process of retrofitting:

- The visibility of the requirements of energy retrofit market entry and acquisition
- The visibility of alternative paths
- The visibility of what leads to successful outcomes

Table 2 presents an overview of the differences between the methods. Next, we discuss these differences in depth.

4.1. Structural aspects

4.1.1. The visibility of project champions and championing intermediaries

The first structural aspect that we discuss is champion visibility in the datasets. During interviews, it was common for the housing company members to refer to a key person who championed and supported an energy retrofit acquisition by outlining different options, evaluating them and acting as a neutral actor between the housing company and the energy retrofit vendors. These championing intermediaries (Martiskainen and Kivimaa, 2018) were typically (in 8/12 cases) energy consultants, whom the housing companies learnt about from their property manager or personal networks. In some housing companies, the board members themselves took active roles as champions (primarily when they were technically skilled to do so).

During ethnography, such intermediating champions were not discovered in the market – despite the fieldworker being informed by energy advisers that a neutral consultant would be important for acquisition and operation in the market, and thus his particular efforts to find one. The fieldworker did not have access to the networks where such champions operate (e.g. access through a knowledgeable property manager) or possess sufficient technical skills to act as a fully-fledged technological champion himself (as in Martiskainen and Kivimaa, 2018). Hence, there was a stark difference between the ease and unproblematic enrolling of champions to support the energy retrofit in the interviews and the non-discovery of such actors in the ethnography.

The difference in champion visibility between the datasets underscores that the recognition of champions and the effect of intermediary actors on micro-level transition processes is much more uncertain and difficult during the process than the interviews on completed projects suggest. This is further consequential difference, as having had a champion was a prerequisite for completing the projects. In our study, finding interviewees who had sought but not implemented an energy retrofit could potentially remedy this bias towards success cases, but finding such informants is difficult, as housing companies rarely signal their intentions to the outside world. Interviews do suggest a further aspect which ethnography underscored: that the evaluation of intermediaries and market actors needs to be carried out constantly during an energy retrofit acquisition. In this regard, interviews are better suited for capturing experiences with intermediaries (i.e., intermediation has taken place but failed or succeeded) whereas ethnography better captures the difficulty and uncertainty of finding and choosing suitable actors in the marketplace (i.e., intermediation is in the

making).

4.1.2. The visibility of the energy retrofit market and ecology of intermediaries

The second structural aspect we discuss is the visibility of the energy renovation market and the typical 'ecology' which several of intermediaries form in the markets (Stewart and Hyysalo, 2008; Hyysalo et al., 2018; Kivimaa et al., 2019a). In retrospective interviews, the marketplace and ecology of intermediaries that the housing companies had operated in when acquiring the energy retrofit was no longer directly available to study. Instead, the market and intermediaries had become embedded in the actions, choices and decisions that the housing companies had made during the process. Some traces of the wider market context were incorporated indirectly in process documentation and there were limited remarks and details in the interviews. Responses to questions about where support and information in the project had been found were often broad and bundled even as details were actively asked, with expressions like 'the Internet', 'Facebook groups', 'fairs' or 'the media' being common. In some interviews, more specific intermediaries that supported the acquisition did pop up during discussion, even if it had been difficult to list them in detail when prompted. In sum, data on the ecology of intermediaries inhabiting the market were limited in detail and down to chance of what was remembered, and the sum and profile of the identified intermediaries a result of the research questions, questions that popped up during the discussion and the time available for the interview.

In the ethnography, the current energy retrofit market and ecology of intermediaries were directly observable and recordable from an adopter's perspective – to the point of potential data overload. Both relevant and irrelevant actors, and intermediaries were equally visible, and this required constant evaluation from the fieldworker to weed out those that were most likely to be relevant for the sites studied (e.g. relevant in terms of their offering and expertise). Further, the detail level of observation was very high as all contacts with the market and intermediaries could be catalogued in depth. For example, the fieldworker was in contact with 20 intermediaries on both sites who were screened as useful for the energy retrofit projects. Meanwhile, 'the Internet' could be broken down into 41 saved searches from over 60 websites – all paired with reflections on their usefulness for adoption. Thus, it was easier to render intermediaries and their activities vis-à-vis the adopter in exhaustive detail through observation than through interviewing.

The difference between our datasets suggests that real-time ethnographic observation excels in capturing a rich and dynamic ecology of intermediaries (i.e., signal and noise), while retrospective interviews are better for capturing the intermediary actors in the ecology that were relevant for a particular retrofit in the past (i.e., signal in the noise). Thus, real-time ethnographic methods are particularly useful for generating an accurate understanding of the agency required of adopters and thus how to support it in an up-to-date fashion. For example, in our studies, some key intermediaries referred to in the interviews had changed their offerings over time or merged with other companies. While such rapid changes in the markets help generate an understanding of the conditions that characterize overall transition processes, such understanding is less useful in efforts to actively stimulate transitions here and now. Furthermore, ethnography was helpful in recognizing and studying intermediaries and the market beyond those intermediaries that researchers have recognized ex ante and have embedded into the research questions. Thus, ethnography can help researchers better reveal previously hidden intermediaries in sustainability transition studies. However, our interviews were better for determining the relevance of specific intermediary actors in the micro-level transition processes we studied. And as interviews can be more easily conducted in larger samples, retrospective interviewing makes it easier to develop typologies and to establish commonalities in transition intermediation.

4.1.3. The visibility of complexity

The third structural aspect we raise is the visibility of complexity in the datasets. Energy retrofit complexity emerged as a relevant issue in the interviews as a descriptive element woven into the overall interview narrative. In practice, this meant that complexity was discussed in regard to certain events and instances in the project. For example, one housing company member provided an illustrative account of the difficulties of comparing heat pumps in response to a question of an energy consultant's involvement in the project. In another housing company, complexity was woven into a discussion about the difficulties in project and system integration. The complexity of acquiring the retrofit was only discussed in a few interviews and was typically overshadowed by later-stage events and challenges, despite being specifically asked about.

In ethnography, the complexity of energy retrofits was omnipresent and a considerable burden that made acquisition and operating in the market difficult. Unlike in the interviews, complexity was not clearly related to certain events, but instead featured as cognitive strain and as an inability to process all the acquired information effectively (for a similar discussion, see De Wilde, 2019). Making sense of the technological options and the site variables had to be considered with each option was particularly challenging. We identified 59 potential energy retrofit technologies or measures in the market – and to make an informed decision about which of them to acquire would require understanding 52 different variables of the adopter site. As learning about energy retrofit opportunities accumulated gradually during the ethnography process, complexity could not be contained and dealt with once and for all, but had to be faced as a part of the process.

The difference in how complexity is portrayed across our datasets underscores a critical point of friction in enacting micro-level transition projects. During the process, complexity can be an overwhelming restriction on adopter agency, and it is only possible to pinpoint the reason for complexity after reflection on the difficulties (this was indeed also the case during our ethnographic observation). In addition, it is reasonable to expect that as adopters learn in micro-level transition processes they perceived them as easier. Hence, complexity may be a particularly problematic issue in setting micro-level projects and transitions into motion and accelerating them (e.g. through mass adoption of energy retrofits). For examining the extent and full effects of complexity, the ethnographic study gives a substantially more detailed and encompassing view than what interviews do. At the same time, retrospective interviewing can outline the challenges that complexity typically creates in micro-level processes, independent of the

particular conditions of the process. While such independent conditions will always have to be dealt with in transition processes, knowledge of common complexities in transition processes may help generate a baseline for the kinds of support intermediaries should provide to support micro-level transition processes and adopter agency.

4.2. Process aspects

4.2.1. The requirements of energy retrofit market entry and acquisition

The first process aspect we discuss is the visibility of the requirements for entering into the energy retrofit market and the acquisition process. We were able to use interviews about successful energy retrofits to capture multiple phases and milestones of the energy retrofit process including the planning, implementation, use and consequences of adoption. However, process scope was traded off with in-depth understanding, detail of the acquisition process and entry to market. The motives behind acquisition were often clearly formulated in the interviews, but the effort required by market entry and acquisition was not revealed in detail. Many interviewees focused on the introduction of the project to the housing company and especially on the period from decision to implementation, and then on to finalization, despite the fact that they often had to expend considerable time and effort before acquisition in making sense of energy retrofits before this could have taken place.

In contrast, it was possible to centre the ethnography specifically on the acquisition process and the hurdles that adopters need to deal with to enter the market. While ethnography did not enable us to place the acquisition phase in a wider context (i.e., how long it is compared to other phases), it enabled gaining a detailed picture of the time spent on entering the market. In ethnography, the slowness of energy retrofit adoption became particularly visible: 83 h of active work was spread over 22 weeks where it was necessary to not only actively seek information but also to gain an understanding of energy retrofits and wait for responses from intermediaries and other actors.

The difference between the results underscores the usefulness of ethnographic methods in detailing the extent of preparatory work that may be required of adopters to engage in micro-level transition processes. It thus shows that even if transition-related technologies are available on the market in principle, their acquisition may be very slow due to the nature of the offerings on the market (e.g. Murto et al., 2019a) or the way in which key intermediaries act (e.g. Zarazua de Ruberns et al., 2018). Thus, ethnography was particularly useful for shedding light onto the early phases of the adoption process, whilst the interview study was good for outlining the overall processes and comparing different cases to each other.

4.2.2. The visibility of alternative paths

The second process aspect is the visibility of alternative paths in the energy retrofit process. In the interviews, the energy retrofit process was transformed into a chronologically ordered, enacted path narrated from a single vantage point. Interviews focused on what has been done (or past enactment) and alternative paths were commonly rendered as losing choices or detours that had been avoided. For example, in the housing companies where district heating had been considered as an option during the process, it was now often referred to as an expensive alternative and a poor choice compared to the system that had been installed – regardless of the potential optimism with which it had been viewed during the process. The uncertainty and work required to weed out the good paths from the bad ones was sometimes made accessible in the interviews through objects and events taking place along the way (e.g. a risk management spreadsheet or a specific decision), but rarely in relation to the early stages of acquisition.

During real-time ethnography, there were multiple potential and often equally interesting alternative energy retrofit paths (and the different technologies associated with them). For example, the field notes reveal a protracted period during which different energy retrofit options and solutions – first solar PV, then 'heating' as an overall category, and later, ground source heat pumps – lead the focus as the envisioned solutions to improve the energy systems of S1 and S2. In addition, the data captured how different energy retrofit possibilities merged or sometimes separated during the process as the fieldworker learned about the technologies and their potentially useful combinations (e.g. that exhaust air heat pumps and waste heat recovery are actually two different technologies). Hence, the ethnography vividly displayed the co-evolution of user understanding and technological choice during the retrofit process. In our study, this process is best characterized as 'muddling through' in the energy retrofit marketplace, which seems – especially when viewed retrospectively – pointless and rather unlikely to be ever adequately described in a retrospective interview beyond informants describing some examples and noting that the process had a muddling through character.

While learning processes and path creation can be studied also in retrospect (see e.g. Bijker, 1995), the difference between our datasets emphasizes how the portrayal of micro-level transition processes may change depending on when it is studied. In interviews, alternative paths in the retrofit had become arranged as a hierarchy (in terms of fit with adopters): there was one clear winning technological configuration to adopt. However, in ethnography, clarity concerning the best path of different alternatives was difficult to achieve and the hierarchy of options in terms of their fit for the site was still in the making. Thus, the benefit of ethnography was in displaying the details of learning and the path-selection work that adopters need to carry out in a micro-level transition project. Retrospective interviews were more valuable in outlining explicit motives behind technological choice and how legitimacy for those choices was achieved in the project.

4.2.3. The visibility of what leads to successful outcomes

The third process aspect revealed by the comparison is the visibility of what leads to successful outcomes in energy retrofits. The interviews were carried out in housing companies where (eventually) successful energy retrofits had been implemented. Hence, through the interviews, it was possible to identify what kinds of actions, events and actors were typically present in successful energy retrofit projects and, further, relatively easily list best practices for implementing energy retrofits. In addition to being successful from

the perspective of acquisition and implementation (defined in advance and through sampling), sites where the system was already in use also shed light on how successful the energy retrofits had been from the housing company perspective (e.g., the financial benefits).

The success of an energy retrofit acquisition in the ethnography sites remained undefined, as there was no certainty over whether the actions that had been taken would lead to a successful acquisition and outcomes. The issue had specifically to do with finding energy retrofit alternatives that would be successful in reducing cost in the long term and would therefore be more likely to pass a vote at a housing company annual meeting. As such, the ethnography was more centred on achieving success from the perspective of the housing company's financial performance, and the study of outcomes would require a longitudinal ethnographic research design – one arguably haunted by the uncertainty about whether and when the energy retrofits would eventually be carried out in the studied settings that were affected not only by the acquisition process but by other contingent events in their decision-making as well (Hyysalo et al., 2019).

The key difference between the methods is in how the uncertainty of outcomes in micro-level transition processes and the difficulty of overcoming uncertainty during the process are displayed. Ethnography was able to capture the uncertainty of micro-level transition processes well (see also Berkhout et al., 2004) and how it challenges adopter agency, while interviews gave a good overview of commonalities between successful adoption cases and intermediation. Moreover, both datasets (and especially the ethnography) underlined that engaging with a transition agenda was rarely the primary purpose of the projects (i.e., energy retrofitting was more often than not a means to reduce living costs). In our data, there were very few instances where environmental concern played a key role in adoption (for similar findings, see Karjalainen and Ahvenniemi, 2019; Hyysalo et al., 2018). Here, we see that when studying sustainability transitions on the micro-level, researchers must pay close attention to the underlying motivation for engaging with processes and projects which appear as transition-relevant (i.e., when sampling for cases based on the outcomes they display, as in our interview study).

5. Discussion and conclusions

Portrayals of sustainability transitions are affected by the methods used in studying them, as is the resulting policy advice. Our work adds to a growing discussion and critical examination of the methodological basis of sustainability transition research (Zolfagharian et al., 2019; Köhler et al., 2019). Our goal has been to clarify methodological choices in advancing transition research that adopts an actor-based view. This is increasingly important for supporting transitions rapidly through the acceleration phase, which requires the mass adoption of transition solutions and a correspondingly deep understanding of transitions on the micro-level.

Based on our comparison with retrospective interviews, real-time ethnographic methods appear beneficial for developing an actor-centric understanding of transition processes as they unfold, particularly regarding micro-level transition processes. They are also beneficial in tracing the actions and rationales of transition-supporting actors, especially intermediaries, and how they contribute (or fail to contribute) to the transition process (cf. Zolfagharian et al., 2019; Guy et al., 2011; Hyysalo et al., 2018). Our findings on how structural issues are revealed in interviews in contrast to ethnography, such as the visibility of intermediaries and champions to adopters, shows that real-time ethnographic methods can add significant insights and detail to our understanding of intermediation processes at the micro-level. In turn, findings in the process dimension of our study invite scrutiny of how retrospection and hindsight potentially downplay the portrayal of key transitions-related conditions, such as uncertainties related to process initiation and outcomes and dynamics of intermediary action (in a similar vein, see Latour, 1987; Bijker, 1995; Garud et al., 2010; Hyysalo, 2010; Höyssä and Hyysalo, 2009; Stewart and Hyysalo, 2008). Hence, zooming in on an ongoing transition and adopting an actor-centric view can reveal key issues of transition intermediation, including issues regarding the understanding of an overarching transition (Zolfagharian et al., 2019; Köhler et al., 2019), and the lack of intermediaries in accelerating transitions.

There are several reasons behind such different yields of methods and data sources. The first has to do with general uncertainty in ongoing processes, as participants cannot know what will happen in the future – something that has been eliminated by the time retrospective data are collected. The second has to do with learning and the operation of human memory: once a process has been finalized, many details appear evident to the actors themselves and the related uncertainties are no longer kept in mind, save perhaps for some key alternative choices. The third is that interviews are always stories: actors, by necessity, present an edited version of events and this is by necessity affected by realized outcomes (Fleck, 1935; Bijker, 1995; Kvale, 2006).

Yet real-time ethnography is no panacea as a method either: it is labour-intensive to deploy across many sites and long periods (which would be particularly desirable in the sustainability transition context). Thus, the urgency associated with – for example – climate action suggests that it may best serve transition research as a needed but specialist tool. Also, ethnographic approaches typically require other types of research to establish the wider context, process and phases, and thus to establish the adequate sampling frame (Hammersley and Atkinson, 1995; Gobo, 2007; Hyysalo et al., 2019).

To thus cap the answer to our research question, ethnographic methods allow for situated views of the frames of actors in transition processes. Such frames have consistency and momentum over time and are an enduring underlying mechanism which informs the study of long-term stability and contingency in transition processes. Also, ethnographic methods are useful for developing a detailed understanding of actors' adoption processes, intermediation and the structural market conditions of accelerating transition technologies. They make visible important actors, barriers to action and dynamics that would be missed in interviews. At the same time, interviews are more effective in contextualizing and generalizing the findings, as creating elegant sampling frames for contextualizing the ethnographic results can prove elusive for emerging sociotechnical and market phenomena, in contrast to more stable settings (Gobo, 2007). Interviews also enable researchers to access the 'inner world' of transition actors (or at least their *expressed* inner world), as interviewing does not rely on researcher-led observation. Thus, interviews can help draw out processes of

Table 3

Comparison of method effectiveness for different situations.

	Effective for:	Less effective for:
Retrospective interviews	- Outlining the process of micro-level transition processes and intermediation and accessing events occurring prior to data collection - Drawing inferences on commonalities in micro-level transition processes - Tapping into the sensemaking of process participants to construct narratives and link incidents and phases of change processes - Gathering data economically about specific issues from various intermediaries and intermediation processes	- Capturing the uncertainty and complexity of micro-level transition processes and intermediation - Capturing a rich ecology of intermediaries involved in micro-level transition processes - Capturing gaps in current transition intermediation processes
Real-time ethnography	-Generating detailed and nuanced understanding of micro-level processes and agency of actors in transitions - Understanding the complexity and uncertainty related to micro-level transition processes and intermediation - Avoiding hindsight bias and post-rationalization of how intermediaries work - Creating situated views of the frames of actors in transition processes. - Discovering new issues at the transition micro-level and intermediation	- Capturing whole micro-level transition processes such as retrofit adoption - Comparing a large number of cases and creating generalizations of micro-level transition intermediation processes and process phases - Sampling strategically in advance to address particular transition intermediation issues

sensemaking and potentially conflicting views across different cases of transition and intermediation. Table 3 summarizes the effectiveness of the methods in studying transition intermediation based on our study.

As a result, we emphasize the value of methodological plurality and multi-method research designs in the study of sustainability transitions. Had we resorted to just one of our methods to understand energy retrofitting, the reliability and validity of our findings about micro-level transition processes, and the nuances of our inferences, would be questionable. For example, without the interviews, champions would have been invisible in our data because the ethnographic fieldwork did not span an entire project from start to finish, while real-time ethnography was essential for understanding the complexity and difficulty of even acquiring energy retrofits for the user (e.g. the complexity and difficulty of finding champions and market actors) and explain why transitions may fail to take off. Moreover, cross-examination and comparison of the datasets was particularly important for contextualizing and triangulating information, and it facilitated the discovery of new issues. For example, the invisibility of energy consultants serving the current housing company market was a finding that depended on knowing that such actors exist (through interviews) and not being able to find them in the market (in the ethnographic participant observation). There is indeed a broad range of methodological options available for researchers in between retrospective interviews and real-time ethnography. For example, provided that suitable cases can be identified for study, repeated interviewing can be conducted in real-time as processes unfold, and can even be turned into progressing series of anticipation and reflection of actions sometimes called temporal nexus interviewing strategy in which interviews cover the present situation and in addition the anticipation of what will happen and reflection of what has happened since the previous interview, Hyysalo, 2010). Just as importantly, occasionally Internet ethnography can provide an easy means to contextualize and compare cases also in retrospect due to accumulation of digital exchanges (e.g. Hyysalo et al., 2018). In all we see great value in combining different research approaches and echo earlier recommendations for the study of sociotechnical phenomena through different vantage points, data sources, levels of granularity and time scales to understand how sociotechnical change happens and to move beyond both limited 'snapshots' and overly generic and coarse high-level depictions (Leonard-Barton, 1990; Pollock and Williams, 2008; Hyysalo, 2010; Hyysalo et al., 2019).

To conclude, a deep understanding of the viewpoints of actors in transitions is key to advancing transitions in practice, and ethnographic methods provide one avenue for improving this. Given the preference in transition research hitherto for largely retrospective interview studies, particularly expert and company interviews, our results underscore how these research methods tend not to draw out complexity and uncertainty, which may severely impair actors, particularly adopters and user intermediaries, from acting in support of transitions. It is thus important to duly foreground the experience and agency of transition actors in sustainability transition research. These uncertainties and complexities are difficult to fully capture through retrospective accounts and will be further lost if the interviewees are not those experiencing the events first-hand, but experts with overall insights. We consider that there is much further work to be done to adapt actor-centric methods and combinations of data sources and methods to serve transition research, especially for studying wider transitions as they unfold in real time. This particularly holds for informal but important transition activities such as the structuring of emergent markets and the roles that intermediaries play in these processes, particularly at the adopter end.

Declaration of Competing Interest

None.

Acknowledgements

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