

To be or about to become? Moral responsibility within transition to community energy ^{*}

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1 Introduction

Decentralization of the energy sector through civic engagement is seen as a pathway to achieving sustainable energy transition [8]. On the one hand, the development of a more decentralized system, together with the intermittent availability of renewable energy sources, increases pressures upon the existing design of the energy systems [5]. On the other hand, due to social innovation, the role of citizens within these sociotechnical systems is also changing. Besides being energy consumers, citizens also become energy suppliers (prosumers) and start organizing themselves via founding community energy.

Since the transition to community energy involves numerous stakeholders interacting on different levels, the social simulation approach has recently gained popularity in capturing the complexity of the ongoing sociotechnical change [17, 4, 14, 7, 13, 6]. The role of moral values and norms is often emphasized as important features in understanding the motives and rationals behind agents' behaviour [17, 4, 2]. However, when approximating human decision-making within these social simulation models, the important notion of responsibility, and more specifically moral responsibility seems to be overlooked. Following Robeyns (2017), we view moral responsibility as an individual character trait that serves as an essential factor in driving agents (non)actions toward more sustainable behaviour [15]. This notion has the capacity to bridge how agents translate descriptive attributes (i.e. what is there) into normative expectations (i.e. what ought to be there). In other words, we introduce moral responsibility as a mechanism that displays how internal attributes of agents are translated into actions for the sake of a more desirable outcome (the outcome that meets normative expectations). We finalize this contribution with the research agenda for further operationalization and empirical analysis of the notion of moral responsibility.

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2 Conceptualizing Moral Responsibility for Community Energy Agent-Based Models

Moral responsibility is a central notion in the context of climate change and energy transitions studies where it is typically discussed as i) a challenge of assigning moral responsibility to and holding morally responsible specific stakeholders (i.e., "many hands problem" [11], or ii) as a driver of individual behaviour [1]. These two perspective on moral responsibility are extensively discussed in Responsible Research and Innovation (RRI), a framework relevant to technological (and system) design and governance [12]. Van de Poel & Sand [12] distinguish between these two types of moral responsibility as backward-looking or historical responsibility and forward-looking responsibility or prospective. In other words, these two perspectives highlight a distinction between holding and taking responsibility.

In the context of community energy, the latter perspective, a prospective and facilitating action responsibility, shed light on an important factor driving individual behaviour towards creating energy communities "bottom-up." Whereas within community energy scholarship there is a growing number of agent-based models studying potential drivers (e.g., leadership by Martiskainen [9] of individual behaviour change, yet moral responsibility as an agent attribute is not included along these drivers.

However, moral responsibility is not just an add-on attribute of agents. To incorporate moral responsibility into ABM of community energy, treating it as a mechanism that translates agent input into action is important. Operationalizing such a mechanism into ABM of community energy requires a rigorous conceptual basis. In this paper, we propose to employ the conceptualization of the moral responsibility mechanism proposed by philosopher Ingrid Robeyns (2017). This conceptualization is particularly suitable for further substantiating the prospective perspective on moral responsibility as a driver of agents' behaviour, one of the motivations behind agent action.

According to Robeyns [15] moral responsibility implies living an ecologically sustainable life by 'taking no more than a fair share'. She points out four control mechanism that prevents people from acting in a responsible manner. In the context of community energy, we operationalize Robeyns' notion of moral responsibility as a four-stage mechanism and link it to normative expectations about sustainability (see Figure 1). First is the lack of basic knowledge mechanisms in which people do not have sufficient knowledge about the problem and consequences of climate change. Second is the common-sense mechanism in which humans struggle to acknowledge their own contribution to the problem of climate change. The third is the moral disengagement mechanism in which people lack the belief that change in individual behaviour makes a difference. Fourth is the unwillingness-denial mechanism, in which humans are (not) willing to give up comfort and old habits to tackle the problem of climate change [15].

3 Modelling Moral Responsibility Mechanism for Community Energy

Conceptualizing and building an agent-based model requires a clear modelling purpose. The purpose of our model is to thoroughly explore the implications of hypotheses about the moral responsibility mechanism being a driver of individual behaviour. This purpose aligns with what Edmonds [3] calls theoretical exploration. We aim to get a broad understanding of the functionality of the responsibility mechanism functions and what understanding of behaviour in energy community context it generates.

To give an illustration of how moral responsibility can be embedded within a social simulation of the community energy transition, we will now elaborate on the sample model. We tested the moral responsibility mechanism in the

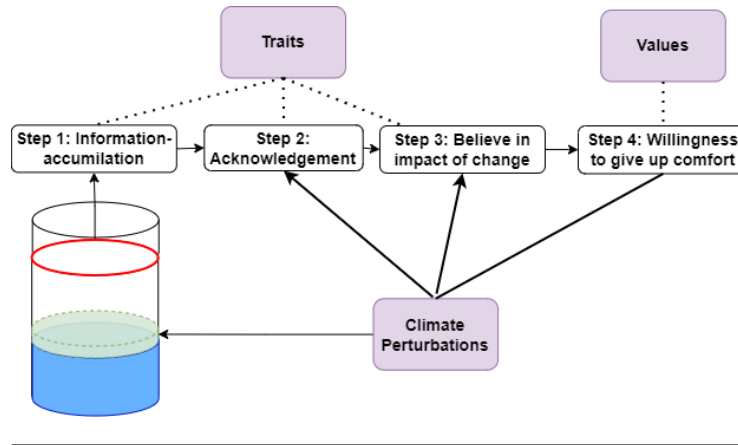


Fig. 1: Flow diagram of the responsibility mechanism

agent-based model of the emergence of decentralized energy systems. Within this model, agents are equipped with the ten Schwartz values [16] and the five OCEAN character traits [10]. Environmental awareness is conceptualized by recognizing sustainability within the belief systems of individuals. To recognize sustainability as a concern and to act accordingly, humans have to realise they can take no more than a fair share of resources. However, the claim that we as people take more than a fair share is often denied due to four control mechanisms [15]. Hence, by deploying an illustrative approach, we shed light on how new values inform people’s decisions and how this relates to the emergence of responsible attitudes in decentralized energy systems. Achieving a responsible attitude is conceptualized as the process of dealing with four control mechanisms.

During the simulation, individuals walk-through the moral responsibility cycle in which they first accumulate information about the ethical implication of

climate change by filling their information tank (lack of knowledge mechanism). Afterwards, based on their traits, agents struggle with acknowledging their contribution to climate change (a common-sense mechanism). During the third step, individuals have to believe that adopting sustainable behaviour on an individual level, will result in a significant improvement on the societal level. However, there is a possibility of disbelieving that individual behaviour changes make a difference (moral disengagement mechanism). Lastly, based on their values, agents possess the willingness to give up current conforms. This can also imply an unwillingness to give up standards that cause the unbalance (an unwillingness-denial mechanism). The first three control mechanisms are considered to be related to the traits of individuals, while the unwillingness-denial mechanism is associated with the value prioritization of individuals.

Completing the moral responsibility cycle for the first time transforms citizens to morally responsible and proactive community members ¹. Completing the moral responsibility cycle for the second time or more will impact the value prioritization of citizens (see ??). An attempt to complete the moral responsibility cycle for the second time could, for example, be related to behavioural change towards different topics (e.g., from community energy to community transport) or a more extreme change (i.e., using bikes rather than cars over longer distances).

Our results² have shown how climate events affect the responsibility of citizens. During experiments, we explored how the distribution of the responsibility level of the population evolves over time for the four population scenarios. Populations with different value orientations and train compositions show differences in recognition of the sustainability-related concerns and dynamics of going through the moral responsibility mechanism. The higher the awareness increase, the faster a citizen accumulates information and reaches Step 1 (Informed) of the responsibility cycle. Whenever the awareness increase surpasses the acknowledgement or belief threshold, a citizen takes one step further towards becoming a responsible citizen.

4 Conclusion and Research Agenda

Integrating moral responsibility within social simulation models is one of the first attempts to embed normative and moral notions within the agent-based modelling practice. First and foremost, our contribution aimed at triggering curiosity in other researchers about conceptualising, formalising and operationalising complex normative notions within computational models. We claimed that a more holistic approach is needed to unscramble drivers of individual behaviour

¹ A responsible citizen does not always behave morally responsible as morally responsible behaviour is also related to a person's willingness and capacity to act.

² We deliberately kept our results brief as the purpose of this contribution is to display the moral responsibility mechanism as an important notion when considering drivers of individual behaviour within the transition to community energy.

when simulating citizens-led energy transition and a moral responsibility mechanism offer a relevant contribution as it is also compatible with other potential incentives (e.g., monetary incentives). The moral responsibility mechanism introduced in this contribution is a step in setting up the research agenda that invites interdisciplinary collaboration from ethical, psychological and sociological perspectives of the potential drivers of individual behaviour. Within our simulation example, we offered a first attempt to embed moral responsibility within the cognitive architecture of agents by linking it to the traits and values, a contribution from a sociopsychology perspective. Based on the exploration of the abstract agent-based model of community energy, we concluded that while dealing with the control mechanisms of moral responsibility, citizens start to integrate relevant concerns within their value system and subsequently advance their capacities to act in a morally responsible manner. At the same time, these conclusions are exploratory and do not intend to represent how moral responsibility functions in actual cases of community energy. We acknowledge that additional empirical studies on how responsible attitudes relate to descriptive and normative concepts like values, norms and traits in the context of community energy need further execution to provide a solid basis for validation of the model and model results.

Furthermore, there certainly are more ways to operationalise moral responsibility mechanisms within ABM. For instance, based on our trials, we focused only on moral responsibility mechanisms on the individual level. Yet, it remains unclear what the aggregated effect of responsible attitudes is on the societal level. Another area to explore is the relationship between people's place in the moral responsibility continuum and their attitude toward participating in community energy projects. When initiating top-down community energy initiatives, these insights could help understand and improve civilians' agency status within these projects and contribute to energy governance studies scholarship.

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