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To Be or to Become? Moral Responsibility Within the Transition to Community Energy

Anna Melnyk and Bart de Bruin

1 Introduction

Decarbonisation and decentralisation of the energy systems through civic engagement are seen as a climate mitigation strategy [1]. With the intermittent availability of renewable energy sources, developing a more decentralised system increases pressures upon the existing design of the energy systems [2]. The role of individual energy consumers within these sociotechnical systems is also changing. Besides being energy consumers, people become energy producers (prosumers) and start organising themselves by founding community energy projects. Such civic activation to achieve sustainable energy transition is called social innovation [1]. Since social innovations like community energy projects involve numerous stakeholders interacting on different levels, the social simulation approach has recently gained popularity. Agent-based modelling is a particularly relevant methodology for capturing the complexity of the ongoing sociotechnical change in the energy transition context with an emphasis on micro and macro levels of behaviour [3–8]. Culture, values, and norms are typically emphasised as important attributes in understanding drivers, motives, and rationals behind agents' behaviour [3, 8, 9]. These attributes

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are contextual and add more granularity underpinning individual and group decision-making.

However, when approximating human decision-making, these social simulation models overlook an important notion of responsibility, specifically moral responsibility. Arguably, moral responsibility is relevant for understanding the dynamics of individual pro-environmental behaviour change [10]. Recent empirical studies investigated the motives for using photovoltaic installation in Poland [11]. They concluded that moral responsibility is one of the main drivers of pro-environmental behaviour that may override economic benefit as a motivation [11]. Other studies in Denmark that focused on the conditions that made the success of the Samsø Renewable Energy Island project possible indicated that responsibility and the sense of locality are important internal contextual conditions that contributed to the success of the project because people typically experience a strong feeling of belonging to the place and community they live in [12].

Thus, while the importance of moral responsibility in driving pro-environmental behaviour is an empirically supported claim, there is a blind spot within the social simulation modelling of community energy systems. Following Robeyns [13], in this contribution, we conceptualise moral responsibility as an individual character trait that serves as an essential factor in driving agents (non-)actions toward more sustainable behaviour [13]. 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 can be translated into actions for the sake of a more desirable outcome (the outcome that meets normative expectations). We finalise this contribution with the research agenda for further operationalisation and empirical analysis of the notion of moral responsibility.

2 Conceptualising 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" [14], or (ii) as a driver of individual behaviour [10]. 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 [15]. Van de Poel and Sand [15] distinguish between these two types of moral responsibility as backwards-looking or historical and forward-looking 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), sheds light on an important factor driving individual

behaviour. An empirical study on the island of Samsø (Denmark) pinpointed that responsibility is strongly intertwined with the place and community where an individual lives. Due to a strong feeling towards a prospect of the place and community where an individual is located, responsibility can be considered an essential internal contextual condition contributing to the success of the community energy project [12]. Within community energy scholarship, many agent-based models study potential drivers (e.g., leadership by Martiskainen [16]) of individual behaviour change, yet moral responsibility as an agent attribute is not included among these drivers. Our contribution proposes to spotlight the role of moral responsibility in the transition to community energy.

Let us first make an important remark. Moral responsibility is not just an add-on attribute of agents. Moral responsibility has a tight link with action since it is a common-sense perspective that individuals are responsible for the outcome of their actions. However, deciding on whether the action is intentional or not may have significant repercussions for the assignment of responsibility. This is extensively discussed in various philosophical debates [17, 18]. While considerations regarding the intentionality of the action may impact how we understand the connection between moral responsibility and action, for this contribution, we will try to keep it simple.

In order to incorporate moral responsibility into an agent-based model of community energy, we propose treating it as a mechanism that directly translates agent input into action. We acknowledge that, in reality, this mechanism is less straightforward. But operationalising even a simplified version of such a mechanism into a social simulation model of community energy already requires a rigorous conceptual basis. In this paper, we employ the conceptualisation of the moral responsibility proposed by philosopher Ingrid Robeyns (2017). This conceptualisation 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 [13], moral responsibility implies living an ecologically sustainable life by 'taking no more than a fair share'. She points out four control mechanisms that prevent people from acting in a responsible manner. In the context of community energy, we operationalise Robeyns' notion of moral responsibility as a four-stage mechanism and link it to normative expectations about sustainability (see Fig. 1). First is the lack of basic knowledge mechanisms in which people do not have sufficient knowledge about the problems and consequences of climate change. Second is the common-sense mechanism in which humans struggle to acknowledge their 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 [13].

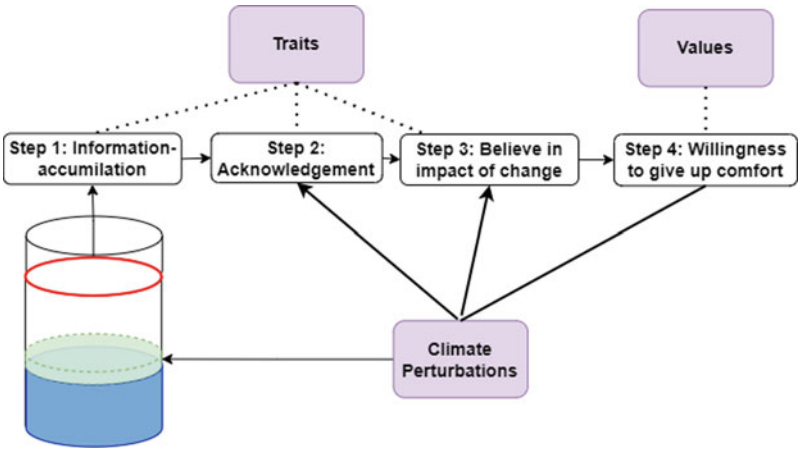

Fig. 1 Flow diagram of the responsibility mechanism

3 Modelling Moral Responsibility Mechanism for Community Energy

Conceptualising and building an agent-based model requires a clear modelling purpose. Our model aims to thoroughly explore the implications of hypotheses about the moral responsibility mechanism being a driver of individual behaviour. This purpose aligns with what Edmonds [19] calls theoretical exploration. We aim to get a broad understanding of the functionality of the responsibility mechanism and what understanding of behaviour it generates in the energy community context.

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 agent-based model of the emergence of decentralised energy systems. Within this model, agents are equipped with the ten Schwartz values [20] and the five OCEAN character traits [21]. Environmental awareness is conceptualised by recognising sustainability within the belief systems of individuals. To recognise 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 [13]. Hence, by deploying an exploratory approach, we shed light on how new values inform people's decisions and how this relates to the emergence of responsible attitudes in decentralised energy systems. Achieving a responsible attitude is conceptualised as the process of dealing with four control mechanisms. Thus, *Responsibility is not a given trait; it gradually emerges due to the process of individual and social learning.*

During the simulation, individuals walk through the moral responsibility cycle in which they first accumulate information about the ethical implications 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 imbalance (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 prioritisation of individuals.

Completing the moral responsibility cycle for the first time transforms individual agents into morally responsible and proactive community members.[1] Completing the moral responsibility cycle for the second time or more will impact the value prioritisation of individual agents (see Fig. 2). 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., from being a member to becoming a community leader).

Our results[2] have shown how climate events and social learning affect the gradual emergence of moral responsibility of individual agents. During experiments, we explored how the distribution of the population's responsibility level evolves over time for the four population scenarios. Populations with different value orientations and trait compositions show differences in recognition of the sustainability-related concerns and dynamics of going through the moral responsibility mechanism. The higher the awareness increases, the faster an individual agent accumulates information and reaches Step 1 (Informed) of the responsibility cycle. Whenever the awareness increases surpasses the acknowledgement or belief threshold, an individual agent takes one step further towards becoming a morally responsible individual agent and acts accordingly. This model, however, is a showcase; it is a simplification that does not intend to capture a real-world phenomenon.

4 Conclusions and Future Research Agenda

Integrating moral responsibility within agent-based models is one of the first attempts to embed normative and moral notions within social simulation modelling practice. Our contribution aimed to trigger curiosity in other researchers about conceptualis-

[1] A responsible individual agent does not always behave morally responsibly as morally responsible behaviour is also related to a person's willingness, intention and capacity to act.

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

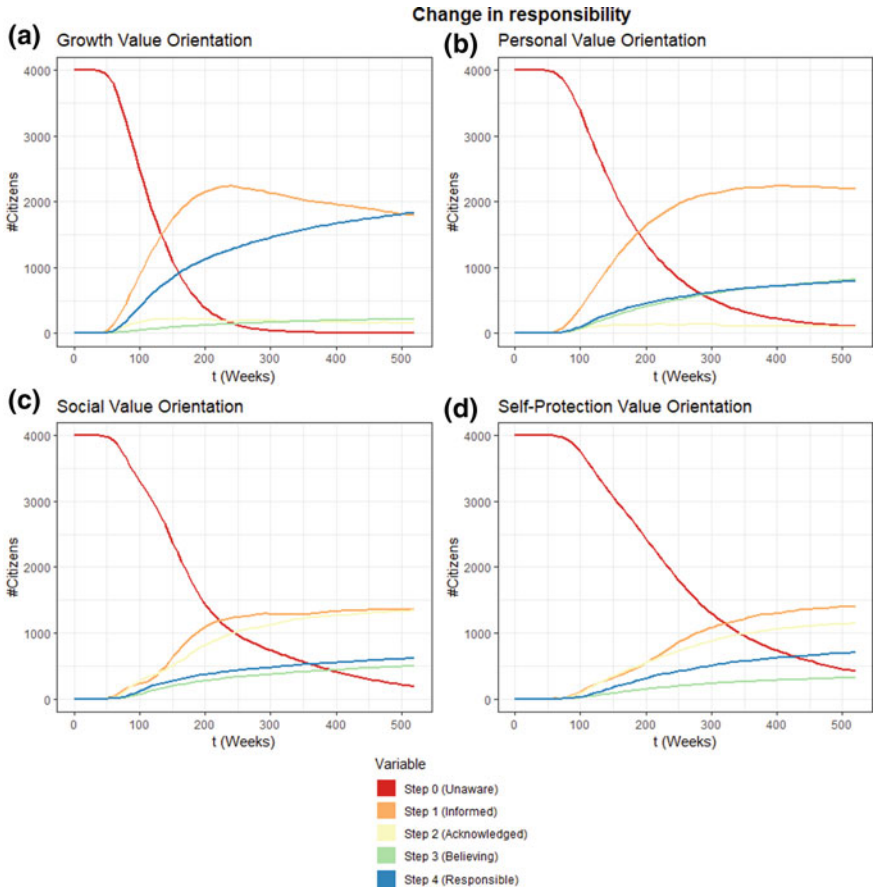

Fig. 2 Change in responsibility

ing, formalising, and operationalising complex normative notions within computational models. More specifically, we claimed that ethical inquiry provides insights relevant to exploring drivers of individual behaviour. In particular, we suggest that when simulating energy transition led by a group of individual agents, the moral responsibility mechanism offers a relevant contribution as it underpins agent action and is 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 the ethical notion of moral responsibility within the cognitive architecture of agents by linking it to the traits and values, a contribution from a social psychology 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, individual

agents 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, more ways exist to operationalise moral responsibility mechanisms within agent-based models. 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 projects, these insights could help understand and improve civilians' agency status within these projects and contribute to the scholarship on energy governance studies.

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