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# Designing role-play simulations for climate change decision-making: A step-by-step approach to facilitate cooperation between science and policy

Audrey Alejandro [a,*], Lucile Maertens [b], Zoé Cheli [c], Augustin Fragnière [d], Oriane Sarrasin [e]

[a] London School of Economics and Political Science, Department of Methodology, Houghton St, London WC2A 2AE, UK
[b] Geneva Graduate Institute of International and Development Studies, Maison de la Paix, Chem. Eugène-Rigot 2, CH-1202 Genève, Switzerland
[c] University of Lausanne, Institute of Political Studies, Quartier UNIL-Mouline, Bâtiment Géopolis, CH-1015 Lausanne, Switzerland
[d] University of Lausanne, Competence Centre in Sustainability, Quartier UNIL-Sorge, Bâtiment Vortex, CH-1015 Lausanne, Switzerland
[e] University of Lausanne, Institute of Psychology, Quartier UNIL-Mouline, Bâtiment Géopolis, CH-1015 Lausanne, Switzerland

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ABSTRACT

Literature has demonstrated the benefits of role-play simulations (RPS) for decision-making and social learning in the field of climate change and environmental policy. Despite growing interest, step-by-step guidelines are still rare when it comes to the practical design and implementation of RPS, which hinders the adoption and implementation of this promising approach. This article aims to facilitate the development of RPS by proposing a step-by-step framework for designing role-play simulations around three stages – before, during, and after the simulation. To develop the methodology, we use as a starting point a pilot simulation on decision-making and knowledge production in contexts of uncertainty and complexity. Focusing on negative emission technologies in Switzerland, the pilot simulation involved 12 scientists and 12 politicians who role-played each other for half a day. Overall, we propose an actionable framework for RPS designed to facilitate cooperation between groups with different socialisations, timelines, and imperatives towards more informed and collaborative decision-making practices. Doing so, this article contributes to making RPS more accessible to a broad audience as a method supporting cooperation between science and policy in the field of climate and environmental politics and beyond.

## 1. Introduction

The literature about the benefits of "serious games" – where players imagine a real situation and play it with specific roles (their own or not) (Flood et al., 2018; Solinska-Nowak et al., 2018) – highlights how gaming supports policy learning through experimentation of complex systems (Mayer, 2009) and social learning through experiencing the importance of collaboration regarding socio-ecological problems (Mochizuki et al., 2021). Serious games have, for instance, been used as educational and engagement tools on the subject of climate adaptation (Flood et al., 2018) and applied in disaster risk management, where they proved to be efficient in raising awareness, encouraging prevention measures, and taking alternate perspectives on a given problem (Solinska-Nowak et al., 2018).

Among serious games, role-play simulations (RPS) refer to games in which participants adopt the roles of others (Vieira Pak and Castillo Brieva, 2010; Wesselow and Stoll-Kleemann, 2018). RPS have been credited with many social benefits as they have the potential to produce social and political change not only through their empirical output but also through the very process of their implementation (Andonova and Mendoza-Castro, 2008; Chasek, 2005; Krain and Shadle, 2006; Schenk and Susskind, 2014). First, RPS allow participants to be immersed in an experiential environment where they can work on authentic problems while being free to try different solutions (Sterman et al., 2014). Second, RPS can be effective tools for networking and acquiring topical knowledge related to environmental policy negotiations and problem-solving (see Dionnet et al., 2008; Hertzog et al., 2014; Rumore et al., 2016; Salvini et al., 2016; Sterman et al., 2014). Third, RPS offer the possibility to facilitate change, for example by enabling stakeholders to develop generic or professional skills (Andersson and Andersson, 2010; Newberry and Collins, 2012). Fourth, RPS encourage participants to explore different perspectives – and thus decentre their own – based on the character they have to embody (O'Sullivan, 2017).

As such, RPS are growingly approached as effective tools for social

* Corresponding author.
*E-mail address:* a.alejandro@lse.ac.uk (A. Alejandro).

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learning, understood as "a process of collective and communicative learning, which may lead to several social outcomes, new skills and knowledge" (Muro and Jeffrey, 2008, p. 330). Social learning is enacted through changes in perceptions, values, and norms (Armitage et al., 2008; Cundill and Rodela, 2012), which RPS facilitate by fostering reflexivity among participants (Chen and Martin, 2015; Loui, 2009). Indeed, participants have to temporarily step into someone else's shoes to adopt their assigned characters' perspective (Easterday et al., 2017), one that might differ from their own, while interacting with other players placed in the same situation. In other words, RPS encourage participants to reflect on other attitudes, experiences, and worldviews and, in return, to critically question theirs (Rumore et al., 2016). Therefore, RPS can help participants examine the perceptions associated with one's identity in contexts where these might inadvertently hamper cooperation and the successful resolution of sensitive policy situations.

Accordingly, RPS have been the object of a growing interest in climate and environment policy for the last decade, on topics ranging from smart agriculture (Salvini et al., 2016) to water management (McEwen et al., 2014), policy deliberations and innovations (Urcuqui--Bustamante et al., 2023), and decision-making in situations of uncertainty (van Pelt et al., 2015). While literature has shown the effectiveness of this method for environmental and climate politics and beyond, guidance demonstrating how to design RPS and harness their learning potential is limited (for exceptions, see ComMod, n.d.; Program on Negotiation at Harvard Law School. n.d.). As a result, researchers and policymakers interested in setting up such initiatives lack templates to develop simulations adapted to the specific problems they want to address. This may both jeopardise the adoption of this promising approach and diminish the quality of the interventions due to a lack of conversation about the practicalities involved in their operationalisation.

To make RPS more accessible to academic and non-academic audiences, we developed a step-by-step framework for designing RPS in contexts of complexity and uncertainty, with a special focus on the science-policy interface (Helmrich and Chester, 2022; Marchau et al., 2019; Marx and Weber, 2012). We concentrate on climate change, for which deep uncertainty occurs when stakeholders and decision-makers do not know the likelihood of alternative scenarios and lack a clear view of the potential consequences of their decisions. This creates challenges when balancing various interests at stake, including planning and governance (Kuzemko et al., 2016) and dealing with conflicting priorities (Constantino and Weber, 2021). Furthermore, research also shows that uncertainty undermines coordination and cooperation, two elements that are however necessary to tackle collective action problems (Brucks and Van Lange, 2008; Newell et al., 2014), notably between scientists and policymakers. With this in mind, we organised two pilot RPS focusing on decision-making related to Negative Emissions Technologies (NETs) in the canton of Vaud, Switzerland, in which 12 scientific actors and 12 regional political actors were invited to role-play each other. In this article, we introduce an actionable methodological framework for designing and setting up RPS supplementary material to facilitate cooperation across groups with different socialisations, timelines, and imperatives towards more informed and collaborative decision-making practices, taking the science-policy interface as an example. To further aid readers, we provide a detailed supplementary material with customisable templates.

## 2. Methodology of the pilot simulations

### 2.1. Context

As RPS are sensitive to their context of implementation (Rumore et al., 2016), it is important to underline the characteristics regarding science and politics of the context in which the simulation took place and based on which we created the scenario: Switzerland. Switzerland is a semi-direct democracy: in addition to executive and legislative bodies at three administrative levels (confederation, cantons, and communes), the citizens have multiple occasions to express themselves through binding referendums. In comparison to other Western democracies, a higher number of public offices are taken on by citizens in a part-time capacity (Bundi et al., 2017; Wurz, 2014), although there is a trend towards a growing professionalisation of politics in the country (Di Capua et al., 2022; Nordbeck et al., 2019). These specificities have implications for the relationship between the scientific and political worlds (Fisch, 2022). Even though politicians might be more representative of the general population than in other political systems, they may have only limited scientific training (Pilotti et al., 2019). It is precisely against this background that we decided to conduct our pilot RPS, to raise political actors' awareness of how science works and scientists' understanding of the political realities on the ground, and, ultimately, enhance collaboration between them.

Our pilot simulations were conducted on November 12, 2021, at the University of Lausanne, a medium-size Swiss university (17000 students) with a clear orientation towards outreach and collaboration with the extra-academic world (UNIL, 2022). During the twelve months necessary for the preparation of the event, the project was led by an organising team of seven people: a member of a competence centre in sustainability, three researchers (two in political sciences and one in social psychology), two members of an action-research unit and the head of the Climate Plan Unit (the cantonal administration in charge of climate policy), who provided useful expertise on the functioning of local politics as well as direct access to a network of policymakers. A project manager (a master's student hired especially for this purpose) supported the research on which the scenario was based, led the design of the event, and produced the material to be used by the participants. Organising team members were mostly tenured employees of the University of Lausanne.

### 2.2. Topic

Inspired by participatory research (see for example Bogatinoska et al., 2022; Chevalier and Buckles, 2019), we organised a workshop to consult with representatives of relevant communities to decide on the topic of the simulations (see Supplementary Material section 1.3). The topic chosen was negative emissions technologies (NETs): technologies and other nature-based solutions aimed to capture carbon dioxide ($CO_2$) already in the atmosphere and store it in geological or biological reservoirs. These techniques span from planting trees, to planting energy crops and capturing $CO_2$ at the smokestack when they are burnt, to big ventilators filtering $CO_2$ from the air (Haszeldine et al., 2018; Maesano et al., 2022).

NETs were chosen as a topic according to four criteria discussed during the workshop:

- They are a fairly new issue in climate politics that is expected to become more prominent, as NETs are increasingly included in national climate strategies (H. B. Smith et al., 2022).
- They involve scientific uncertainty about their scalability and about their energetic and economic feasibility because many NETs are at an early stage of development (Mander et al., 2017).
- They raise decision-making challenges due to potential conflicts with other sectors such as land planning, agriculture, energy policy, and biodiversity conservation.
- They are multi-dimensional political and scientific objects involving technical and governance issues, which require mobilising interdisciplinary academic literature, and prompt technical questions.

Overall, choosing NETs matched our objective of having participants experience (i) the constraints of the other professional group (e.g., scientists' challenges of working across disciplinary scientific boundaries and politicians' challenge of accommodating the political weighing of different interests), (ii) the need for closer collaboration between

scientific actors and decision-makers. Within the question of NETs, we narrowed down our RPS around the question of bioenergy with carbon capture and storage (BECCS), as it is the most featured NET in the IPCC's emission pathways (P. Smith et al., 2019).

### 2.3. Scenario

The same scenario was carried out across two simultaneous pilot simulations to collect more evidence on the process while decreasing the logistical costs related to the organisation. Each of the two simulations gathered two teams of six participants (twenty-four participants in total split into four groups). Four adjacent separated rooms were used to dispatch teams. Teams were comprised of either (i) six political actors role-playing scientific characters from different disciplinary backgrounds, or (ii) six scientific actors role-playing political characters with contrasting partisan orientations (for details on participants' recruitment and profiles, see Supplementary Material section 1.4.). One facilitator was attributed to each team.

To enable each professional group to experience what the other group usually does in real life, the scenario comprised tasks specifically designed for the scientific and political actors (see Supplementary Material Section 2) dealing with the potential implementation of NET solutions on a wide scale in the area in which they were based (Canton de Vaud, Switzerland): Table 1.

**Table 1**
"Before the simulation" – Initial steps to design and prepare a role-play simulation for political and scientific actors.

| | |
|---|---|
| Designing the scenario | - Identify the topic for the scenario and the learning objectives for each professional group.<br>- Conduct preliminary research: documentation on the topic, consultation with scientific and political actors to assess current views and practices.<br>- Create a scenario: define the tasks for each group, delineate the storyline including disruptive events and actors' interventions.<br>- Check the role-play's relevance, credibility, and feasibility with partners (e.g. through a workshop).<br>- Design characters and their profiles.<br>- Write the detailed scenario. |
| Preparing the material | - Create a roadmap for the simulation: decide the expected timing for each sequence and create a sequential timeline.<br>- Prepare the collective material (e.g. introductory video, forms to fill, etc.)<br>- Provide the information documents specific to each character:<br>• For scientific actors, this could be summaries of and/or excerpts from 2–3 scientific articles, findings of past studies, and methodological material.<br>• For political actors, this could be governmental publications (e.g. official reports), media sources, opinion polls, partisan position papers, and advocacy documents by civil society organisations or the private sector.<br>- Define 'external' interventions with their necessary material: character's profile and supporting material. |
| Setting up data collection | - Prepare questionnaires to assess the views of participants before and after the simulation.<br>- Set up the observation protocol: write observation grid, select observers.<br>- Define confidentiality rules (e.g. Chatham House Rule). |
| Rehearsing and improve | - Organise a rehearsal of the simulation (e.g. with students).<br>- Debrief with the participants and organising team after the rehearsal and identify necessary improvements.<br>- Revise the scenario and material. |
| Organising the event | - Identify and invite participants.<br>- Prepare the logistical organisation of the event: secure a venue with appropriate equipment, print all the material and assemble folders for each character, prepare a present to thank participants.<br>- Distribute tasks among the organising team: team facilitators, coordinator(s) who ensures the smooth running of the scenario between the different rooms, actors with fictional interventions, observers.<br>- If relevant, contact the media to set up media coverage. |

- The political actors role-playing scientific characters were asked to write an interdisciplinary grant proposal on NETs and a summary of currently available knowledge for policymakers. While experiencing the challenges of interdisciplinarity, they also had to consider the ethical dimensions of researching controversial and potentially hazardous technologies.
- The scientific actors role-playing political characters were asked to define political guidelines for the regulation of NETs implementation in the region and had to deliberate on granting the authorisation for the implementation of a BECCS pilot project that was presented to them. The scenario therefore demanded scientific actors to experience the challenges of collegiality in Swiss politics, e.g. having to find a consensus among members of (radically) opposite parties and reflect on resource allocation and conflicting interests when it comes to implementing a concrete NET project.
- The teams from different professional groups had to exchange information at several points of the scenario, mimicking usual interactions at the science-policy interface (Lacey et al., 2018; Watson, 2005).

## 3. Introducing a step-by-step approach to role-play simulations

### 3.1. Before the simulation

#### 3.1.1. Designing the scenario

The first step requires aligning the scenario with the simulation project's objectives, in our case enabling participants to experience what their counterparts usually do in real life to foster a better understanding between political and scientific actors. To be realistic, the RPS must be based on a complex issue involving a) scientific uncertainty and b) a politically relevant topic on which politicians would have to make decisions. For the scientific side, the topic should be of interest to different disciplines, and the subject of ongoing controversies with both emerging findings and remaining uncertainties. For the political side, the scenario must ensure that in-game characters would have jurisdiction to make decisions on this issue. This requires prior knowledge of the topic itself but also of the political system and the division of labour among different political arenas. To help with the selection process, we suggest choosing a topic on which the organising team has prior expertise, conducting preliminary research and consulting with scientific and political actors to assess current views and practices.

In parallel, characters should be designed. The chosen profiles depend on the topic at hand, but they also should reflect commonplace positions within academia and the political world to create a scenario that appears realistic to the participants. Each character should have a short biography including their background, position, and personal views and interests (see Supplementary Material Section 5). For scientific characters, we suggest including discipline, career stage, areas of research, methodological practices, and personal interests relevant to the topic. For political characters, we suggest partisan orientation, role (executive, legislative, high administration) and status, relation to science, and personal interests relevant to the topic. Characters should be realistic without being too caricatural, which proved to be quite a challenge in our case. Such experience aligns with Toth's (1988) emphasis on the difficulty of finding the correct degree of abstraction in designing simulations: how to address the tension between the necessity of getting participants out of their routinised patterns while still preserving the basic features of reality to remain relevant to participants' real situations. For this reason, it is of crucial importance to have characters reviewed by experts (e.g. individuals with similar roles in real life and not involved in the simulation).

Finally, the scenario delimits the storyline of the role-play leading each team through different steps to achieve the defined goals. Each

group should have credible objectives (see Supplementary Material Section 4) that mirror the daily activities of scientific and political actors such as writing a grant proposal or adopting political guidelines. The scenario is designed to guide the participants towards achieving such goals through fictional but realistic steps. The role-play's relevance, credibility, and feasibility should be checked with partners (e.g. through a workshop) before writing the detailed scenario including disruptive events (see Supplementary Material section 10), moments of exchanges between the two professional groups (e.g. the political characters requesting a summary for policymakers to the scientific characters) and actors' interventions (e.g. a fictional representative from civil society). A sample of the scenario we designed is available in the Supplementary Material, along with excerpts of the supporting material to the simulation, which was assembled into a simulation kit.

### 3.1.2. Preparing the material

The next step is then to turn the detailed scenario into a roadmap that indicates the expected timing for each sequence. This document unpacks the sequential timeline for facilitators to guide participants during the entire simulation. Contact points between the professional groups are recommended but should be set with adequate timing.

To help participants get familiar with and progress through the scenario, they receive material, such as written documents, videos, or forms to be filled in step by step (see Supplementary Material Section 4 to 10), as summarised in Table 2:

The level of expertise of the material needs to be carefully adapted to the participants' profiles and connected to the RPS's objectives and duration. The material should reflect the current stage of the scientific and political debates on the chosen topic and provide contrasting arguments on a subject that has not reached a large scientific consensus yet, but which also leaves room for compromises. When participants read through their personalised folders, facilitators can accompany them to avoid misunderstanding the character they have to embody.

Finally, external interventions – fictional interventions carried out by external actors (e.g. a member of the organising team) to convey new information and move the scenario forward – provide lively interactions and can add a level of complexity to mimic the constraints of each field (e.g. the university's president giving guidelines to the scientific team, or a journalist presenting new public opinion poll results). Each intervention should be designed with the necessary material, like a brochure introduced by a fictional private company to the politicians or a series of questions guiding a fictional media interview.

**Table 2**
List of the material provided to the participants.

| Types of material provided to the participants | Objectives | Examples |
|---|---|---|
| Introductory material | Gives the necessary information to set up the game and understand the team's goals. | Objective cards specifying the team's goals; introductory video; forms to fill in. |
| Additional material | Provides further information (with potential differences and dissonances between different members of the same team); can introduce a disruptive event. | *Scientific characters:* An email asking for a press interview. *Political characters:* A request from civil society for consultation |
| Character-specific material | Helps participants get into character and learn about the chosen topic from the perspective of their character. | *Scientific characters:* Excerpts from 2-3 scientific articles; findings from existing studies; methodological material. *Political characters:* Governmental publications (e.g. official reports); media sources; opinion polls, partisan position papers; advocacy documents by civil society organisations or the private sector. |

### 3.1.3. Preparing data collection

Two reasons justify setting up a protocol for data collection: first to assess the RPS's outcomes in terms of social experiment and learning tools, and second, to use RPS as a research method to produce empirical results about embodied practices, professional habits, and perceptions. It is worth noting that questionnaires, interviews, and debriefing also represent an opportunity for participants to self-assess and a potential tool for reflexivity.

As social experiments and learning tools, RPS are guided by specific objectives (Schenk and Susskind, 2014) that can be evaluated by assessing:

- how participants perceive their contributions to the simulation;
- how participants perceive the contributions of other participants;
- participants' experience of taking part in the simulation, and how this experience may help them to reflect on or change their perceptions, practices and interactions.

As a research method aimed at producing empirical results (Urcuqui-Bustamante et al., 2023), RPS help collect data on:

- group dynamics and attitudes;
- professional habits and ability to critically reflect on them;
- the way participants perceive their role, consider the opposite group, and view the chosen topic.

To evaluate the outcomes of the interventions and to collect research-oriented data, we recommend setting up a mixed-method approach (Leech and Onwuegbuzie, 2009) through quantitative methods – such as pre- and post-test design questionnaires – and qualitative methods – such as observation, interviews, and debriefing (see Supplementary Material sections 11 and 12). When it comes to the questionnaires, social desirability processes are likely to occur immediately before/after a small-scale event due to the fear of not being anonymous being heightened within a small sample. Thus, instructions should be phrased so participants feel comfortable expressing negative views about the experiment. Observation protocols supplement participants' questionnaires by informing on the group dynamics and attitudes participants would not share in their answers (e.g. controversial views, or opinions perceived as irrelevant or unimportant). The observation grid is designed to assess: (i) how the simulation unfolded; (ii) how participants embodied their characters and which views on politics/science showed through their acting; (iii) the content of the debates and the implicit beliefs embedded in their discourse.

### 3.1.4. Organising the event

We encourage organisers to rehearse the simulation (e.g. with students as participants) before the event. Testing the material and the timing of the scenario helps identify necessary improvements and revisions. Rehearsing also contributes to testing the data collection protocol (e.g. questionnaire, observation grid) and making the necessary adjustments.

Identifying and inviting potential participants is a long process that we suggest starting as early as possible, as participants such as political and scientific actors tend to have very busy schedules. Participant recruitment depends on the simulation's objectives and the chosen topic, and, in our case, we aspired for a balance between political affiliations for the political actors and between scientific disciplines for the scientific actors. We encourage selecting participants that are not experts on the topic of the scenario to increase the potential learning experience and limit the risks of having one person take over the discussion.

To increase our chances for potential participants to accept our invitation to the RPS: (i) we outlined the salience and relevance of the topic on which participants will acquire knowledge; (ii) we presented the simulation as a networking activity (e.g. early confirmation of the participation of prominent political/scientific actors helped recruiting other participants); (iii) for the politicians, we highlighted the importance of representativeness of the political landscape, incentivising all parties to send participants to ensure their party's presence; (iv) media coverage also can be a motivating factor for participants to attend, provided that confidentiality rules are communicated in advance. Indeed, to offer a certain visibility to the experiment, media coverage of the event can be planned with local media outlets or the university's communication services.

Finally, attributing specific responsibilities is a critical step. Key roles that the organising team must endorse or externalise are summarised in Table 3 (see also Table 4 for more detailed tasks to implement during the simulation). RPS are events designed to reach creative decisions; for this reason, the facilitators' role is to provide guidance and a structure to the various planned activities without influencing the participants' actions. We therefore suggest applying facilitation and moderation techniques as presented in the literature (Hofstede et al., 2010; Leigh et al., 2021). Table 5.

### 3.2. During the simulation

#### 3.2.1. Warming up

Participants are invited to be on site a bit ahead of the formal start of the simulation to allow some time for an introduction. A name tag with participants' real name (and maybe job title), is provided. The introduction can include informal exchanges (e.g. a coffee break or a lunch) and a plenary presentation that introduces the objectives and broad outlines of the event. To this end, the participation of the University's leadership is welcome. It is also an opportunity to clarify the general rules (e.g. no use of computer equipment or mobile phones during the simulation), which are necessary when conducting RPS. Regarding the publicization of the event, it may be appropriate to use Chatham House rules, which allow to publicise remarks issued during the experiment but guarantee the anonymity of their author, thus allowing participants to freely interpret their character. This helps reduce the fear of being held responsible for statements that could be detrimental to them, even if these result from their character's interpretation. At the end of the introduction, participants are asked to fill in the pre-questionnaire.

We encourage organisers to prepare a protocol for role allocation as it is a pivotal moment that can influence how much participants will get into their roles. For instance: (i) facilitators are positioned at the entrance of each simulation room, while participants continue to have informal exchanges in a far enough dedicated space; (ii) one by one, participants are invited to join their team facilitator to randomly draw a card describing a character; (iii) to help players step into their role, the facilitator introduces each participant to their character in a few sentences prepared beforehand that encapsulate the salient features of their character (these can highlight, for example, the character's subtext that is important to the game mechanics); (iv) participants are invited to replace their "real" name tag with that of the character; (v) the player can enter the room, take their assigned seat and have a moment to read the character's description while the other participants complete the same procedure until everyone is set to start.

#### 3.2.2. Overseeing the progress of the scenario

A strategy should be planned to ensure the proper conduct of the various activities included in the scenario and to simplify the use of the materials provided. Regarding the unfolding of the scenario, each facilitator should have a detailed log for the whole event (see Supplementary Material Section 3), indicating (i) the timing and time of the activities, (ii) a description of the task(s) to be accomplished and (iii) the corresponding supporting material. The facilitators and coordinators should be in regular communication (e.g. through an instant messaging

**Table 3**
Organisers' roles and main tasks.

| Roles | Main tasks | Profile |
|---|---|---|
| Facilitators - one per team | *Facilitation tasks:*<br>- Introduce the scenario to the team.<br>- Assist the team to progress in the scenario.<br>- Time management.<br>- Coordinate with the organising team.<br>*Moderation tasks:*<br>- Ensure the balanced involvement of participants.<br>- Ensure that communication is moderated in a respectful way for all participants. | Involved in the simulation design; experienced in group leadership and facilitation/ moderation techniques; expertise on the chosen topic is an asset. |
| Coordinator(s) | - Introduce the event.<br>- Ensure the smooth running of the scenario between the different rooms.<br>- Introduce and coordinate external interventions.<br>- Answer technical questions on the chosen topic. | Involved in the simulation design; experienced in event management and coordination; expertise on the chosen topic. |
| Actors | - Carry out an external intervention designed for the scenario. | Comfortable with public speaking; expertise and experience related to the characters they play are an asset. |
| Observers | - Observe the simulation and fill in the observation grid. | Familiar with qualitative methods; detailed-oriented; experience with intensive notetaking is an asset. |

**Table 4**
"During the simulation" – Steps to conduct a role-play simulation with political and scientific actors.

| | |
|---|---|
| Warming up | - Coordinators introduce the event (e.g. with the support of the University's leadership).<br>- Coordinators introduce ground rules for the event.<br>- Coordinators ask participants to fill in the pre-simulation questionnaire.<br>- Facilitators assign characters and introduce participants to their roles.<br>- Facilitators give directions to help participants get into character (e.g. rephrase the profile card to insist on important dimensions). |
| Overseeing the progress of the scenario | - Coordinators introduce the external actors and new information at the right moment and check the scenario progress between the different rooms.<br>- Facilitators share the material progressively as the scenario unfolds (e.g. number documents to reflect the sequencing).<br>- Facilitators give deadlines for each sequence to make sure the scenario progresses as planned.<br>- Facilitators update on the scenario's advancement among the organising team (e.g. through a group chat).<br>- Facilitators and coordinators adapt the scenario if necessary (e.g. skip a sequence).<br>- Coordinators oversee the observation process. |
| Concluding the event | - Facilitators end the activities as determined in the scenario.<br>- Facilitators and coordinators debrief with participants and give them the opportunity to share their experience with the other group.<br>- Coordinators ask participants to fill in the post-simulation questionnaire. |

system), to ensure that each team is ready for the timed activities (e.g. the external interventions or communications between teams), to avoid disturbing the group dynamics and arrange for timing adjustments if necessary. To allow facilitators to know exactly which document from the material is to be given at each step of the scenario, each document can be assigned a number indicated at the top of the page and reproduced in the log.

Even with a precisely planned and rehearsed scenario, unforeseen events can happen. For example, participants may be chatty and thus disrupt timing; they may have unexpected reactions to some interventions; or they may reach some decisions faster than expected. For these reasons, facilitators should always be in contact with each others and with the coordinator(s) and be prepared to skip some events in the scenario if needed.

#### 3.2.3. Concluding the event

The simulation does not end with the last step of the scenario. Indeed, as an initiative aiming for social learning, the event concludes with a debriefing session, which involves "sharing, discussing, reviewing and reflecting on the experience, evaluating these and integrating them into the minds of participants" (O'Sullivan, 2017, 617). The literature has emphasised the indispensability of this debriefing phase for RPS (Crookall, 2010; Lederman, 1992). Debriefing allows participants to reflect and share their experience and enables them to make sense of and further learn from it.

Literature highlights different types of debriefing that range from group-based discussions (McFagden and Huitema, 2017; Rumore et al., 2016) to individual written debriefing (Crookall, 2014; Petranek, 2000). Whatever the type of debriefing selected, the session should be aligned with the simulation's purpose (Peters and Vissers, 2004). As such, we advise preparing adapted questions leading the conversation in advance.

Additionally, participants can fill in the post-questionnaire designed to evaluate learning outcomes before or after debriefing, depending on whether researchers want the collective conversations to potentially influence participants' answers. We recommend inviting participants to fill them on site (rather than sending them by email), to ensure a response rate as high as possible. On the downside, by filling in two questionnaires on the same day, participants may remember the responses they provided in the pre-test questionnaire. Several techniques may be used here, such as randomising the order of the questions, using 0–100 sliders (in online questionnaires) instead of 5 or 6-point Likert scales, or using a different layout.

### 3.3. After the simulation

#### 3.3.1. Analysing the data (and further data collection)

Analysing the collected data enables to assess the completion of the learning objectives (Schnurr et al., 2014; Urcuqui-Bustamante et al., 2022). For instance, Likert-type items scales can evaluate to which extent participants were able to put themselves into someone else's shoes, and whether their representation of others' roles or functions is less stereotypical (see Supplementary Material, section 13). As mentioned in Section 3.1.3., data collected during the event can also be exploited when applying RPS as a research method. In all cases, the analysis of different sources of data can be interpreted separately, but their simultaneous examination is likely to bring more detailed and relevant information (Leech and Onwuegbuzie, 2009).

Aside from the data collected during the simulation, additional data can be collected after the simulation, with methods such as semi-directed interviews or a second post-test questionnaire in the following months to assess medium-term changes for participants. Indeed, shortly after the RPS, participants' attitudes might be strongly influenced by what they have just experienced, but returning to personal and work habits may decrease the influence of the RPS.

**Table 5**
"After the simulation" – Steps to increase the simulation's significance.

| | |
|---|---|
| Gathering and analysing the data | - Debrief with the observation team and review observation notes.<br>- Analyse data.<br>- Ask for voluntary feedback from the participants (e.g. by email) and/or conduct follow-up interviews.<br>- Assess the learning outcomes of the event. |
| Following-up | - Send a thank you note to the participants.<br>- Share potential outputs with the participants (e.g. video of the event, media coverage, future projects).<br>- To replicate the simulation: debrief after the event, identify necessary improvements, and adjust the scenario and material. |

#### 3.3.2. Following up and dissemination

After the simulation, it is important to dedicate time to publicising the event and following up with the participants. A thank-you email is an opportunity to share the outputs of the media coverage and solicit feedback and suggestions, which is especially useful if the organising team plans to repeat the simulation with other participants. The published outcomes of the coverage can then be shared with participants to help increase the meaningfulness of the participation and develop a sense of collective ownership towards this initiative.

Considering the time invested in the development of the simulation and to capitalise on the know-how acquired, the organising team may consider repeating the simulation. The material is already prepared and ready to be improved upon thanks to the adjustments identified. Therefore, to leverage the transformative objectives of an RPS, the same simulation could be held with different participants (e.g. with political actors from the next term or, provided minor adaptation, political and scientific actors from another area with similar institutional characteristics). From a research point of view, replication would also allow to collect more data and thus solidify the first results obtained. Finally, the simulation could also be used in other settings, for instance with students in a university course to introduce them to the question of science-policy dialogue as well as to the specific topic of the simulation. RPS on similar subjects have indeed successfully been experimented with in classrooms (Matzner and Herrenbrück, 2017; Stokes and Selin, 2016).

## 4. Conclusion

This article provides a step-by-step framework for designing and conducting RPS for climate and environmental policy. It offers practical guidelines to elaborate a scenario, select participants, and conduct the simulation to promote social learning and cooperation in complex decision-making processes. Given the high potential of RPS, this article intends to provide very concrete cues to encourage their implementation and reduce some of the costs associated with these time-intensive tools.

While a full assessment of the outcomes of RPS is beyond the scope of this article, our experience of conducting the pilots aligns with existing literature (see introduction). RPS are likely to serve as effective learning environments, introducing complex issues and disseminating information on specific topics. Participants gain awareness of scientific debates, and political processes, enhancing their understanding of the chosen topic. Additionally, RPS allow political and scientific actors to experience each other's perspectives, routines, constraints, and temporalities, potentially leading to a reflection on their views and practices. They provide a playful environment for participants to step out of their comfort zones, question their assumptions, and reflect on themselves. However, selecting the right level of abstraction when designing a simulation to ensure its credibility and the transferability of its learning outcomes to the real world can be challenging. Future research comparing different designs could assess the learning outcomes associated with distinct types of RPS. Finally, we also see RPS as a promising tool for participatory action research (PAR) in two ways: by engaging relevant stakeholders in the design of the simulation, and by offering

RPS as services to local governments and scientific organisations, considering the methodology we developed aimed to be institutionalised by the host University as a new type of PAR initiative for science-policy impact.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data Availability

We have shared the data in the supplementary material.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.envsci.2023.103650.

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**Dr Audrey Alejandro** is an Assistant Professor at the Department of Methodology, London School of Economics and Political Science. She researches knowledge and discourse in world politics and society and develops methodological tools to better account for and mobilises such processes for social change. She has conducted research on these questions in India, Brazil and the Caribbean.

**Lucile Maertens** is Associate Professor in Political Science and International Relations at the Geneva Graduate Institute of International and Development Studies, co-director of the Global Governance Centre and scientific collaborator at the University of Lausanne. Her current research focuses on international organizations, multilateral practices, global environmental governance and issues of temporality and (de)politicization. She has also published on research methods, and more recently on pedagogy and role-play simulations.

**Zoé Cheli** is a research assistant in political science and international relations. She completed her master's degree in sustainability and environmental sciences at the University of Lausanne. She currently works on Dr Maertens' research project investigating international environmental policies during the Covid-19 pandemic.

**Dr Augustin Fragnière** is Deputy Director of the Competence Centre in Sustainability and Head of the research group. His areas of expertise focus on sustainability theory, climate justice and democratic theory related to environmental issues. He has conducted research on these topics in Switzerland, France and the United States. For a few years, he has been actively promoting dialogue between science and politics.

**Dr Oriane Sarrasin** is a Senior Lecturer and Research Fellow in Social Psychology at the Institute of Psychology of the University of Lausanne. Her research focuses on the antecedents of socio-political attitudes and behaviors. She masters various methodological approaches, from the analysis of survey data to the development of experimental designs. For several years and from an action-research perspective, she has been interested in the perception of the climate emergency and the factors underlying and promoting ecological actions.