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Experiential Learning of Local Relational Tasks for Global Sustainable Development by Using a Behavioral Simulation

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The interdependent character of sustainability challenges calls for collaboration among actors with different capabilities, interests, and knowledge frames. Behavioral simulations offer good opportunities to learn about dealing with these differences. They are based on an "experiential learning" approach that integrates the direct experience of the participants during a simulation exercise with reflection, theorizing, and acting. As such the simulation is able to mobilize the "minds, hearts, and hands" of the participants to stimulate not only cognitive, but also affective and moral learning in an embodied way. This is considered of utmost importance in education for sustainable development. The simulation exercise presented in this manuscript is inspired by a real case in the Southern Andes of Ecuador, where an existing multi-actor committee for the co-management of the regional UNESCO Biosphere is challenged by the arrival of an international mining company. The results are based on an analysis of the simulation sessions with three different groups: (1) social and environmental experts that have experience in the context of the case; (2) students in International Business Management; and (3) students in Water Engineering. The participants tap into the potential of individual and group reflection to learn from their own experience. They demonstrate an increased awareness of the importance of the relations between the stakeholders to deal adequately with the wicked nature of the case. The innovation of the tool consists in the possibility to address in a systematic and explicit way the relational tasks that are needed in local contexts to address global sustainability challenges. Especially the attention given to ambidexterity to address the tough tension between collaboration and power plays is rarely covered by other tools.

Keywords: behavioral simulation, sustainable development, biosphere, mining, multi-actor collaboration, experiential learning

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INTRODUCTION

All the main sustainability challenges, like climate change, food insecurity, poverty, increasing inequality, loss of biodiversity, resource depletion, health problems related to contamination, etc. are interconnected and value-laden (Welcome in the Anthropocene). Coping adequately with these challenges requires that the mutual dependencies existing among different actors are taken into

account. This raises the need for collaboration between actors involved in a shared local reality in order to contribute to sustainable development at a global level (Multi-Actor Collaboration for Sustainable Development). It requires an enhanced awareness of the relational tasks that are needed to collaborate and handle situations where disagreement and conflict may arise (Learning to Manage Multi-Actor Governance in a Complex and Ambiguous World). Here, we propose experiential learning as an educational approach and behavioral simulations as learning tools in higher education to learn about these important relational tasks for sustainable development (3). The "Mining in the Biosphere" simulation is presented as an example of such a simulation (4). The insights that the participants acquire with this simulation, are based on the observation of classroom practices and on an analysis of the individual learning reports in three different groups: academic scholars and experienced professionals in local sustainable development at the University of Cuenca, Ecuador, students of the master program in international business economics and management at KU Leuven university, Belgium, and students of the master program in water engineering at the University of Twente, The Netherlands (5). We conclude with a discussion about the unique value of this simulation as a versatile learning instrument to learn about the relational tasks that need to be addressed in concrete local contexts to advance global sustainable development (6).

Welcome in the Anthropocene

Geologists speak about a new era in the history of our planet Earth, the Anthropocene. They have observed that the human factor has a decisive influence on all ecological systems of which human societies are part (Olsson et al., 2014; Steffen et al., 2015). The behavior of complex socio-ecological systems is the result of the interaction between a countless number of human and non-human actors that depend on each other for their survival and the well-being at system level. Socio-ecological systems are in a dynamic equilibrium and in permanent evolution. When too much (natural or human-induced) external pressure is exerted, they become extremely unstable, "turbulent" until they find a new equilibrium (Richardson et al., 2005). The relatively stable period of the Holocene allowed the development of human societies as we know them nowadays. However, it seems that we are now in the "bumpy" transition period toward the Anthropocene. In our interconnected world whatever activity in one place can have—often unexpected—consequences in other places and on the global system. Collaboration between actors locally is a must to avoid that the transition to the Anthropocene leads humanity to a planet with adverse ecological conditions and growing social tensions globally, and to lead humanity on the path toward sustainable development (Gray and Purdy, 2018).

Taking into account the complexity of socio-ecological systems implies dealing with the inherent uncertainty and ambiguity of complex system behavior (Brugnach et al., 2008). Uncertainty refers to the (relative) unpredictability of future evolutions. Ambiguity refers to the different ways that actors perceive and conceive the changes around them, according to their interests, former experiences and (cultural, disciplinary, ...) perspectives (Craps and Brugnach, 2015). However, the management and governance systems that are still dominant nowadays, were designed in different times and contexts, with more predictable demands, clearer social priorities, and more stable ecological conditions. In these former circumstances, with a low degree of uncertainty and ambiguity, clear-cut problems can be solved with rational problem solving which guarantee the most efficient use of resources. However, in turbulent and complex socio-ecological conditions, management is not only confronted with increased unpredictability but also with increased debate about what is really at stake, what are the main problems that should be addressed and which solution alternatives should be prioritized. The problems with which management is confronted are called "wicked" because they don't have one best definitive solution (Rittel and Webber, 1973; Termeer and Kessener, 2007). Attempts to arrive at a solution often result in unexpected and undesirable side-effects elsewhere, that tend to affect mostly powerless actors, "without voice" in the debates.

If wicked problems can't be definitively solved, the question is then if we can learn anyhow to deal at best with them. Higher education highlights the importance of evidence-based science in decision-making. This leads to an emphasis on measurements and data-management in sustainability education (Jickling and Sterling, 2017). However, the inherent ambiguity of complex sustainability challenges can't be solved by generating more data, because the involved actors first have to agree on the frameworks in which these data fit and make sense (Brugnach and Ingram, 2012). Dealing with ambiguity requires thus identifying, mobilizing and connecting relevant actors who have to negotiate, dialogue, and co-create solutions at the system level of which they all depend (Craps et al., 2016, Brugnach et al., 2011). Negotiation strategies correspond to conditions in which actors with different perspectives, positions, experiences, resources, and possibilities defend their own interests. A dialogical learning strategy takes these differences as opportunities which should be explored when complex challenges at the level of a whole system are at stake (Bouwen and Taillieu, 2004; Dewulf et al., 2005).

The environmental, financial, health, and other system crises that the world has faced in recent times, have fomented an awareness that by relying exclusively on markets or governments we are unable to deal with complex, interconnected system problems (Scharmer and Kaufer, 2013). Policy arenas have been complemented with civil society actors, protesting in the name of the victims of the dominant market economy and reclaiming their rights and benefits through social corrections and environmental measures. This is when multi-actor collaboration comes into play. In the following section we explain this concept which reflects a search for how actors belonging to different sectors should respond jointly to shared challenges.

Multi-Actor Collaboration for Sustainable Development

Multi-actor collaboration, as conceived in this context of sustainable development, is a social process, in which representatives of a diversity of constituencies, through open

and respectful dialogue gradually come to synergetic solutions, satisfying all the involved actors, "beyond their own limited vision of what is possible" (Gray, 1989; Gray and Purdy, 2018). However, collaborative initiatives are often confronted with contradictory interests, incommensurable perspectives, and disparate power. Collaborative action strategies put emphasis on building consensus and finding common ground. This requires trust, openness, mutual understanding, and dialogical skills among the involved actors.

A distinction should be made between "transactional" and "transformational" interactions between the participants in multi-actor initiatives. Transactional multi-actor collaborations are about defending vested interests of the actors directly involved in joint initiatives. In these cases actors focus on their own specific issues. Interactions among them tend to be conflictive. Conflicts are resolved by bargaining and transacting, based on the principles of distributive negotiations, which means: give as little as possible to the other, and take as much as possible for yourself (Fisher and Ury, 1981). Although this kind of negotiations has allowed important social adjustments—the Western so-called social welfare state can be considered an example of it—they have not been able to prevent the socio-economic system stretching the planetary boundaries and excluding a major part of humankind from decent living conditions.

Transformational multi-actor collaboration is based on principles that Fisher and Ury (~~1991~~) describe as part of integrative negotiation. In this case, the involved actors identify with what they share and have in common. Scharmer and Kaufer (2013) refer to it as "eco-system awareness," which is different from the "stakeholder awareness" in the case of transactional collaboration. Participants in transformational collaboration do not act as mere representatives of stakeholders with one single interest, but as authentic persons, with complex identities and interests. As a consequence, their interrelations mirror the complexity of the outside world. Informal social systems, based on mutual, open-ended commitment are much more adequate than bureaucratic structures for that purpose (Kania et al., 2018).

Multi-actor collaboration is predominantly buttressed by a constructionist approach in organization and management studies, that conceives collaboration as an emergent social reality in-the-making through interactions between individuals and groups (Bouwen and Taillieu, 2004). Collaborative initiatives take shape and evolve as actors interact over time. The moment-by-moment interactions become the most salient benchmarks for the collaboration, which brings group dynamics to the foreground. A group learns to collaborate by engaging in a joint collaborative initiative. Interactions provide opportunities for learning (Bouwen and Taillieu, 2004). Participants interpret each other's interventions not only at substantive level, which refers to the content quality of their contributions, but also at relational level, which stimulates repositioning and fine-tuning mutual expectations and interactions. As actors become more comfortable addressing the quality of their interactions, learning about how to manage issues together intensifies and opens new possibilities for action. However, this development is far from sure and heavily depends on the capacity to cope constructively with diversity (Vansina and Taillieu, 1997; Bommel Van et al., 2009).

As we conceive multi-actor collaboration as a fundamentally interactive learning process, learning theories regarding organizational learning (Argyris and Schön, 1978; Hosking and Bouwen, 2000), social learning (Wenger, 2000; Pahl-Wostl and Hare, 2004), and group development (Bouwen and Hovelynck, 2006), largely inform the next section.

Learning to Manage Multi-Actor Governance in A Complex and Ambiguous World

Hovelynck et al. (2020) describe three types of relational tasks that have to be realized simultaneously in multi-actor collaboration: connecting, confronting, and committing. Although the authors acknowledge the importance of these three tasks throughout the multi-actor process, they consider connecting as a precondition for generative confrontation. Connecting generates the breeding ground for richer insights and innovative proposals to deal with the complex challenges that bring the participants together. The interplay between connecting and confronting sets the stage for commitment by all involved actors. In the following paragraphs we will present some key concepts concerning these three relational tasks, that are covered by the learning process with the simulation as an educational tool, that we present in the next section.

Connecting

Stakeholder Relations Management

Collaboration starts by connecting relevant actors that are related to a shared reality which may trigger or challenge them in different ways, according to their framing of that reality. Connecting is in the first place concerned with identifying, mobilizing and convening the required stakeholders (Horisch et al., 2014; Curçeu and Schruijer, 2017). According to Mitchell et al. (1997) stakeholders are more important to the degree that they have more power, legitimacy and urgency in the issue under consideration. Actors with sufficient legitimacy and credibility among the other actors concerning the issue at stake, should act as conveners who can convince them to engage in a multi-actor endeavor. Facilitators have the important task of establishing adequate contexts for social relations, with which each participant feels sufficiently at ease to express what really matters for him or her.

Framing and Re-framing

Connecting involves however not only taking care of the relational qualities of the interactions between the participants. It involves also that participants familiarize themselves with the specific ways the others frame reality, and that they understand how the others' framing can be meaningfully connected with their own way of framing the reality (Dewulf and Bouwen, 2012). Connecting means then that the involved actors are able to re-frame their shared reality in such a way that it acknowledges its ambiguous and complex nature with respect for the different interests and perspectives (Dewulf et al., 2005).

Confronting

Power in Collaboration

Although collaboration is conceived as an emergent process, in which actors through open and respectful dialogue gradually come to synergetic solutions, multi-actor initiatives are often confronted with contradictory interests, incommensurable perspectives and disparate power (Avelino and Wittmayer, 2015).They frequently have to start in contexts that are characterized by historical, deep-rooted rivalries, and conflicts between the involved actors (Lewicki et al., 2002). As a consequence, initiatives risk to result in a win-lose zero sum game instead of the expected synergy, through which the most powerful actors use their power to serve their own interests at the expense of the others. Local communities and long term environmental concerns are frequently victims of this power play (ACIDH, 2011).

The growing inequalities, the competition for increasingly scarce resources and situations of environmental injustice, which take place in contemporary societies worldwide, seem in favor of a power perspective as the most realistic and "down to earth" option. Indeed, in these circumstances an emancipatory action strategy, which critically analyzes the power plays among the actors and empowers weaker actors, may be necessary. According to political scientists and philosophers such as Chantal Mouffe and Slavoj Zizek, conflicts of interest and power plays are an essential aspect of democratic societies and multi-actor initiatives should not "depoliticize" them (Kenis and Mathijs, 2014). They advocate for "re-politicizing" debates when sustainability issues are at stake, to make conflicts of interests visible. This may inspire public protests, civil disobedience, or other forms of political activism.

Although power action strategies may seem contradictory to collaboration, both are interrelated and need each other. Collaboration needs differences, resistance, and a certain degree of conflict to push the multi-actor group toward finding jointly creative and innovative solutions at a higher system level. Without empowerment stronger parties risk destroying the weaker ones, arriving at monopolistic positions. An important task for a multi-actor initiative consists then in developing the ability for constructive conflict. The ambidexterity concept, explained in the next section, aims precisely at contributing to this ability.

Ambidexterity

Ambidexterity, "the ability to perform differing and often competing strategic acts at the same time" (Simsek et al., 2009) is a concept that helps clarify how connecting and confronting action strategies can be tuned with each other. The concept, which in the context of Corporate Social Performance addresses the tension between economic competition and societal responsibility (Hahn et al., 2016), refers here to the ability of actors belonging to a shared multi-actor setting to deal deliberately and adequately with the tension between connecting and confronting.

Cao and Gedajlovic (2009) distinguish two dimensions in ambidexterity: balancing and combining. Balancing means using simultaneously but separately actions that belong to two different action strategies, connecting and confronting, so that one action can compensate for the weakness of the other, e.g., while actors are involved in a dialogue, it can be useful to invest simultaneously in supporting the weaker parties, by giving them technical support, or by coaching their negotiation skills. Balancing is probably the best alternative when there is much ambiguity concerning the issues at stake and when there is much pressure from powerful actors to impose their interests. Potential solutions are then prepared separately with different actors outside the joint multi-actor space. Critical actors are tolerated or even supported, without pressuring them to participate directly in the multi-actor initiative, to avoid affecting their credibility as spokesperson of legitimate constituencies.

Combining two action strategies in one activity on the other hand can make this activity more effective, because both action strategies facilitate and reinforce each other. E.g., involving weaker and stronger actors in a joint activity, may empower the weaker parties as they learn how their interests can be affected by the others. Stronger actors may learn to accept the requests of weaker actors in a less defensive and more empathic way. Combining confrontation with connecting action strategies in one activity is useful to unleash the creativity that is needed for creating novel insights and innovative solutions for complex problems. Synergy requires linking mechanisms that can reunite actors with profound differences. Examples of linking mechanisms are: go-betweens, double (or multiple) identities, shared activities, mixed legal structures, joint fact finding, participatory model building, etc. (Craps et al., 2004).

Committing

Participation in Decision-Making and Implementation

Commitment and trust are emergent aspects of the interaction and are finally put to the test during implementation. Depending on the reciprocity in this process, actors commit to agreed-upon decisions, and later they commit to joint efforts (Hovelynck et al., 2020). The "ladder of participation" (Arnstein, 1969) has been a commonly used framework to visualize the gradual involvement of initially excluded actors of civil society in (public) decision making. The lower rungs of the ladder refer to manipulative practices, giving excluded actors an illusion of participation without real involvement. Climbing up the ladder leads from less participative and more unilateral decision-making based on one-way communication (informing, consultation, placation) to more participative partnerships based on open, two-way communication between all actors, and finally resulting in complete citizen control.

Collins and Ison (2009) point out that in the case of complex sustainability challenges such a hierarchical view on participation, transferring complete control from one (public) to another (civil society) actor is inadequate. They advocate instead for social learning, a governance approach which is in line with the multi-actor approach of this publication. Through social learning different actors learn to manage together complex sustainability issues, by gradually appreciating complementary insights and resources of each participant.

Communication With Constituencies and Broader Society

External communication about collaborative efforts and output toward the constituent organizations and the broader society is important to foster commitment. It generates feedback from the members of these organizations and it urges the involved actors in the multi-actor initiative to take a stand for their efforts in the broader society.

Representatives of "under-organized" organizations that have conflicting views internally regarding the issue at stake, will possibly have a difficult task to convince their constituencies of the multi-actor agreements and engagement. This is often the case for local community leaders, in contrast with the leaders of public and private sector organizations, that are more formally and hierarchically organized. The challenge for these representatives and leaders can be understood by what is known as the "dilemma of the negotiator" in negotiation literature. As the members of an organization often lack the shared experiences and open conversations of their representatives in the multi-actor activities, they tend to stick to their original, more defensive positions. Communicative skills are important for leaders to justify their choices and share their learning insights with their constituencies.

LEARNING ENVIRONMENT

UNESCO's Sustainable Development Goal number four, quality education, calls for "an action-oriented, transformative pedagogy, which supports self-directed learning, participation, and collaboration, [...] and problem-orientation" (Gaffney and Kcenia O'Neil, 2018). According to these authors pedagogical approaches based on experiential learning fulfill these expectations. In this section we explain first briefly the basic tenets of experiential learning, and then we present behavioral simulations as adequate learning tools to put in practice experiential learning on complex topics related to sustainable development in a classroom setting.

Experiential Learning

Experiential learning finds its inspiration in a diversity of action-oriented pedagogies, based on a "learning-by-doing" approach of the pragmatic educational theorist John Dewey, and other influential educators for social change like Kurt Lewin, Paulo Freire, and Carl Rogers. With this approach the focus in education shifts from teaching to learning (Kolb and Kolb, 2005). Instead of teaching as transmitting cognitive contents, the educator generates opportunities in which learners can have impactful experiences, can reflect on these experiences and on their own contributions, can theorize about these reflections, and finally can experiment with new ideas and behaviors for change.

Kolb (1983) describes an experiential learning cycle in four steps: (1) Learning starts with a person being confronted with a rich experience of a concrete situation; (2) This experience stimulates systematic reflection on the experience; (3) Subsequently the learner looks for theoretical frameworks to integrate the reflections, to make sense of the experience and to come up with action possibilities to intervene in the situation; (4) and finally the learner will try out in practice these possible actions. Feedback on the outcomes of the interventions brings the learner again at the start of a continuous learning cycle. Although Kolb's original conception of experiential learning was still predominantly focused on cognitive learning, its potential for "whole-person" learning has later been recognized (Sipos et al., 2008). Indeed, in experiential learning learners are involved as whole persons, not only intellectually but with all senses, with emotions and values, thinking, and acting. This allows integrating affective, imaginal, spiritual, and practical aspects in the learning process. Through joint experiences learners connect not only to their own emotions, but they connect also with the others involved in the learning experience, and with the broader world in which the experience takes place. Instead of teaching about sustainability, education based on experiential learning can become transformative learning for sustainability when the learners engage in the activity with the intent to transform the concrete situation toward a more inclusive, sustainable world (Sipos et al., 2008; Jickling and Sterling, 2017).

Sipos et al. (2008) advocate for learning with "head, hands and heart" to stimulate this kind of experience-based transformative learning for sustainability. Learning with the head refers to intellectual, cognitive engagement to correctly understand the basic facts, principles, and mechanisms of sustainable development. This implies paying attention to complex systems, critical thinking, and transdisciplinary learning. Learning with the hands means that transformative learning for sustainability must foresee opportunities to practice skills that are needed for participation, conflict resolution, and democratic decision making. Learning with the heart is stimulated when the participants are involved with passion, they can live their deeper values, unleash their creativity and experience fun, and this in an inclusive environment.

In the next section we present behavioral simulations as an educational tool for experience-based transformative sustainability learning, stimulating learning with the head, hands, and heart.

Behavioral Simulations

Behavioral simulations have been described as learning instruments for individuals involved in multi-actor initiatives (Vansina et al., 1996; De Weerdt et al., 2009; Prins, 2009) and more specifically also for sustainability related challenges (Annandale and Morrisson-Saunders, 2007; Svoboda and Whalen, 2007; Stefanska et al., 2011; Magnuszewski et al., 2018). They consist of a description of a problematic situation in which different interested actors have to interact to resolve the problematic situation. The participants in the simulation are divided in groups, putting themselves in the position of the different actors involved in the simulated case. They can meet and interact with the others in internal meetings (within their own actor group), bilateral meetings (with one other or a limited number of other groups) and multi-lateral meetings (plenary, or "town hall" through representatives).

Simulations resemble role-playing, but there is an important difference. In simulations the roles of the actors are not prescribed but completely open for improvisation by the participants. They have to identify with the actor group of which

they are part and act from the perspective: "What would I do being in this position?"

Simulations are opportunities for the participants to experience a relevant, complex and challenging situation, but they are only a first step in the experiential learning cycle. Subsequently the participants are stimulated to reflect on their experience, to enrich these reflections with conceptual frameworks, to experiment with alternative ways of intervening in the simulated reality, and finally to apply the learning insights in similar situations in their own life.

The "Mining in the Biosphere" Simulation

A Real Case as Inspiration

The simulation is based on a real (still ongoing) case concerning mining and sustainable resources management in the Southern Andes of Ecuador. In this case a broad group of local and national actors collaboratively obtained the official recognition by UNESCO of their region as a Biosphere area. Biospheres are geographical areas with an exceptional diversity of habitats, including protected areas (National Parks), productive areas (e.g., for agriculture) and human settlements and cities. Their main purpose is to serve as spaces for training and education about local, regional, national, and global sustainable development. The "El Cajas Biosphere," the case inspiring the simulation, covers an area of 976,000 has, ranging from 4,450 m above sea level till the tropical Western Pacific Coast. It includes five completely different socio-ecological zones: mangrove swamps and tropical lowlands, deserts and dry bush, cloud forests, altitude agriculture and pasture, and moorlands. The "National Park El Cajas" is a protected part in the center of the biosphere of 28,000 has with 768 lakes and waterholes. This area is very important for the water supply of nearby Cuenca, the third city of the country with over 400.000 inhabitants (Rodríguez et al., 2013).

The diverse group of actors that lobbied for the UNESCO recognition, has constituted a multi-actor committee for the joint management of the Biosphere. They are inspired by the sustainability-related principles of "the Good Living" ("Sumac Kawsay" in the Kitchwa indigenous language), a key concept of the National Constitution. The arrival of a multinational mining company strongly challenges the multi-actor committee. It causes intense debates, as well within as between the actor groups concerning the acceptability of mining operations in the Biosphere. The company promises to enhance the economic opportunities and basic services for the region, but simultaneously threatens the fragile socio-ecological environment.

The actors represent a high degree of horizontal diversity (between different sectors of society: governments, civil society, companies, urban, and rural groups) as well as vertical diversity (local, regional, national, and international level). There are major differences in sources and degrees of power between the involved actors in the simulation. Although at first sight this may seem a simple polarized conflict between a mighty "Goliath" (the mining company as bad guy), and the poor but morally superior "David" (the locals), the simulation evokes a much more complex panorama, in which each of the actors has to deal not only with external but also with internal tensions about the possibility of incorporating mining activities in the Biosphere, although each actor for very different reasons.

The simulation is based on existing documents and first-hand information by two alumni of former training programs regarding multi-actor collaboration for sustainability (facilitated by the first author). They were both actively involved in the multi-actor process which resulted successfully in the acknowledgment by UNESCO of the area as Biosphere in 2013 (one representing the local government of the nearby city and one representing an important environmental NGO).

Different Steps

The whole learning process with the simulation involves four steps: (1) An (optional) preparatory phase, providing relevant conceptual frameworks ~~(Learning to Manage Multi-Actor Governance in a Complex and Ambiguous World);~~ (2) Playing the simulation ~~(The "Mining in the Biosphere" Simulation);~~ (3) Group reflection on the simulated experience ~~(Group Reflection);~~ (4) Learning reports ~~(Individual Learning Reports).~~

In this section we focus on the second step, which is dedicated to the simulation as such.

Introducing the Simulation

After explaining the general principles and learning objectives of the simulation, as presented in the former section, the participants receive a general description of the situation in which the simulation takes place. This is a synthesis of that description:

"The Ministry of the Environment has given the operating license for mining to the multinational company Junefield. The mining site is situated in the UNESCO Biosphere, near a National Park area. The company can start the exploitation of the estimated reserves of 605,000 ounces of gold and 4,300,000 ounces of silver. A tunnel will be excavated to extract 800 tons of rock daily over the course of 8 years. Tailing ponds will be created on site for the mining waste. The possible environmental impacts can affect (…) the waterways, livestock production, cacao, banana trees, shrimp and fish. According to Ecuadorian legislation, at least 51% of the economic benefits by mining have to go to the National Government, to attend to the needs of the neighboring communities (…) like roads, schools and sanitary systems (…). The appropriate treatment of mining is imperative for the future of the region. The UNESCO Biosphere is managed by a Multi-actor Committee, of which four of the five actors in this simulation are members (but not the mining company). The Committee has not yet formally considered if and how this activity could fit within the objectives of the "Good Living" principles of the National Constitution and the function of the Biosphere, and how to reduce the possible negative social and environmental impacts, in case the mine would go ahead."

The task for the participants in the simulation is presented as follows:

- "Define how the Biosphere Multi-actor Management Committee can become an appropriate space to deal with issues related to mining"
- "Define the conditions under which the Biosphere Management Committee can accept the mining activities,

and the mechanisms for control and monitoring of these conditions."

Conforming Actor Groups

The participants are divided into five actor groups. In reality there were many more actors, but for the didactical purpose of this exercise the actor constellation is reduced to the following actors: the National Planning Department (NPD); the local indigenous community, living in the immediate neighborhood of the mining site; the Chamber of Commerce of a nearby city; the environmental Non-Governmental Organization Green World (NGO); and the management team of the Multinational Company Junefield.

Participants can freely choose the group in which they want to participate. They tend to choose an actor group with which they identify or sympathize spontaneously. However, they are stimulated to participate in a different group, as this will give them an opportunity to explore reality from another perspective as they are used to. A maximum or different number of participants can be established for the actor groups, e.g., in the simulation exercises that we analyzed for this publication, the number of participants in the mining management team and in the National Planning Department was limited to five, whereas the number of participants in the local community was open.

Apart from the general description of the situation ~~(Introducing the Simulation),~~ the participants also receive specific information for their own actor group separately. This information is according to the interest, the access to information sources and former experiences of the actors in reality. As a consequence, at the start of the simulation exercise, the participants do not know which information the other groups have.

Interaction Rounds and Duration

The simulation starts with a first internal meeting, in the own actor group, to assimilate the information, define their position and decide their action strategy toward the others. Next there is opportunity for bilateral meetings, followed by a first multilateral meeting ("town hall"), with one representative of each group, and all other participants observing without intervening. The central question of the first town hall meeting deals with the question how the multi-actor committee for the co-management of the Biosphere should be adapted to deal with the new challenges related to mining. After this first meeting the representatives go back to their own group, and discuss internally the course and outcomes of the first town hall meeting. Then they can enter in bilateral conversations with other groups and adapt their strategy, before starting a new multilateral meeting.

One cycle of these three types of meetings takes at least 1 ~~h.~~ We consider that at least two cycles are needed. Taking into account the time needed to introduce the simulation and the debriefing afterwards ~~(Debriefing)~~ a simulation session will take at least 3 ~~h.~~ However, it is recommended to take more time, e.g., one whole day, and to add more interaction rounds. This allows the development of a richer and more varied evolution in the relation process of the simulation, and a more profound identification of the participants with their own actor group. A simulation session should be complemented with at least one additional session for reflection and analysis ~~(Group Reflection).~~

Debriefing

Immediately after finishing the simulation, it is convenient to foresee an opportunity for the participants to express the emotions felt during the exercise and their satisfaction with the outcomes of it. For this debriefing they stay in their own actor groups as they express themselves while still identifying with their actor perspective. They reflect on the questions:

- To what extent did we achieve the expectations of our own group? How and why (or why not)?
- To what extent did we take into account the expectations of the other groups and did we achieve common goals? How and why (or why not)?

To stimulate this reflection, a two-dimensional graph can be used with "own objectives" on the vertical axis and "common objectives" on the horizontal axis ~~(**Figure 2**)~~. Each participant is invited to stick a dot with the corresponding color of their own actor group in this graph.

In a plenary session participants share what mostly has called their attention during the simulation. They have to avoid continuing discussions that are related to the content of the simulation and they are stimulated to focus their attention on the relational processes. This is an important step toward the reflection and analysis of the relational tasks that will be described in the next section.

Tools for Reflection and Analysis

Group Reflection

To start the reflection, the participants are invited to identify what were the most critical moments or significant events that happened during the simulation ("interventions or interactions that had a decisive influence on the further course and the outcome of the simulation"), and to put brief descriptions of these moments on a timeline of the simulation. They explain what happened exactly at that moment from their perspective: who did or said what to whom, and how this felt; and the others add their perspective to these incidents. This critical incidents exercise may stimulate participants to look at the simulation experience from different perspectives. It may also enrich the reflective conversations with concrete illustrations.

Subsequently the participants are organized in mixed groups (with members of different actor groups in the simulation) to exchange experiences and reflect on them. Each group has to focus on one important aspect of multi-actor collaboration (see section Learning to Manage Multi-Actor Governance in a Complex and Ambiguous World).

- Stakeholder relations management: analyse the stakeholder characteristics (power, legitimacy, and urgency) of the actors involved in the simulation, and the way these characteristics were taken into account.
- Framing and re-framing: how did the participants deal with the different perspectives and interests in play, and did they

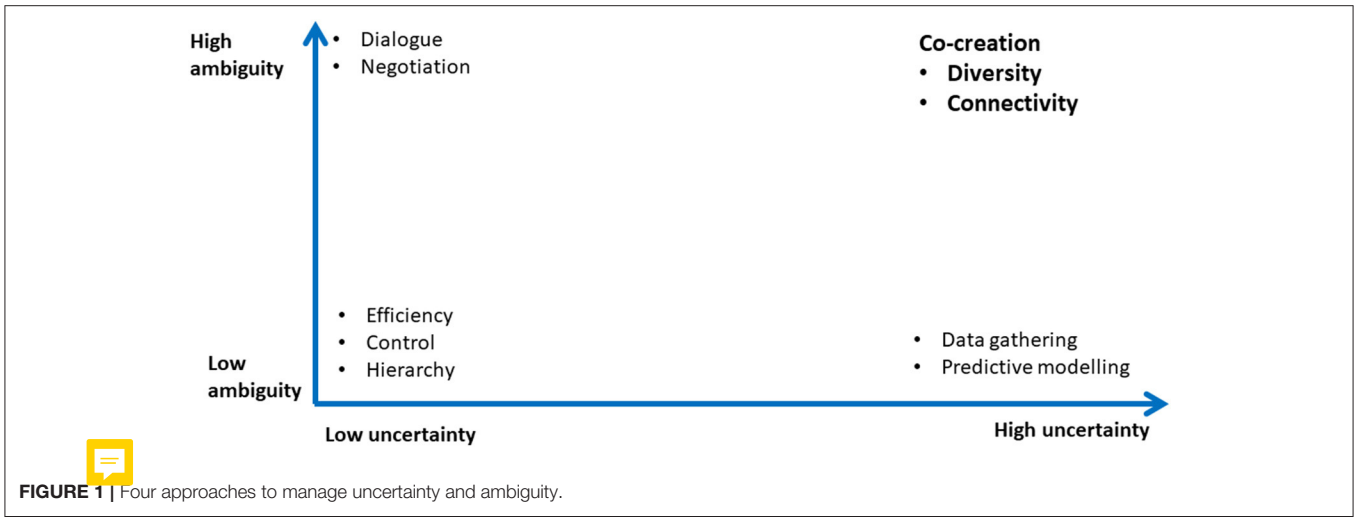

FIGURE 1 | Four approaches to manage uncertainty and ambiguity.

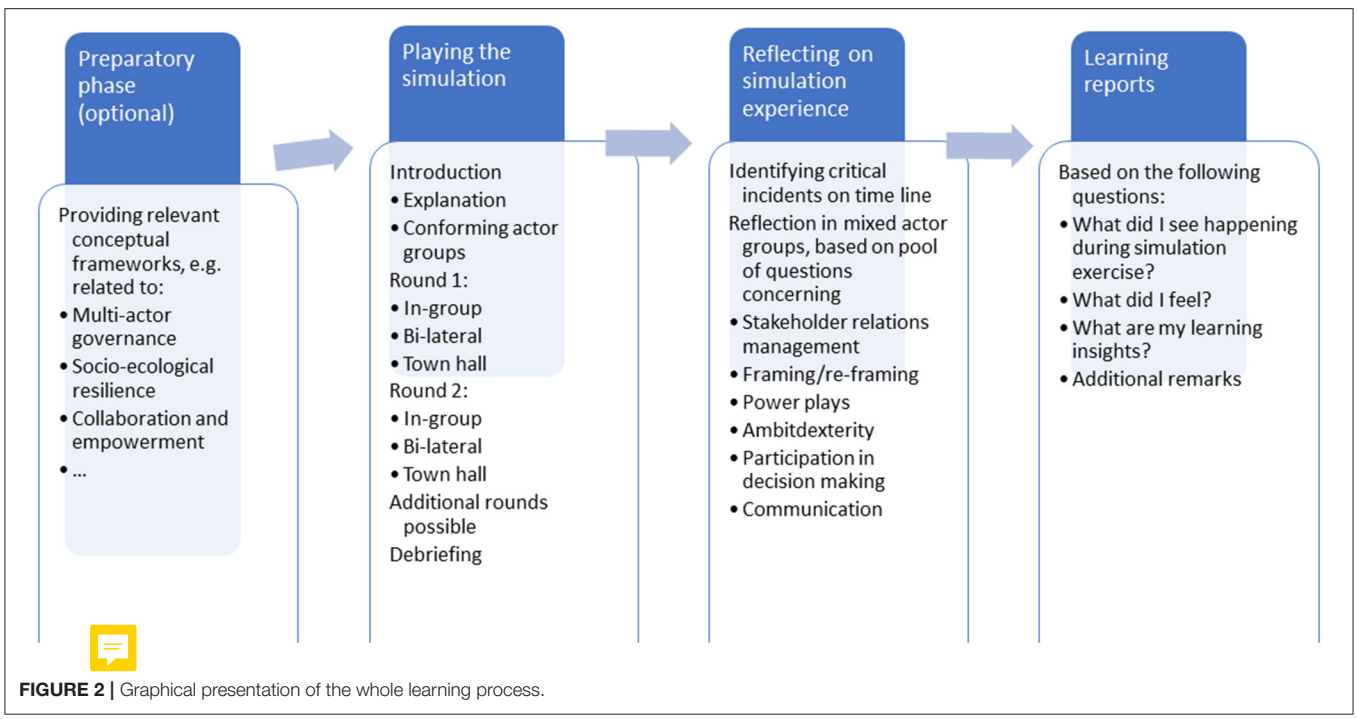

FIGURE 2 | Graphical presentation of the whole learning process.

actively try to connect these differences into proposals that can be shared by all?

- Power plays: were conversations and negotiations rather based on distributing advantages and disadvantages among the participants in a transactional way, according to the power resources of each; or were there also efforts to transform the challenges of the starting situation into a sustainable outcome, by integrating social, ecological, and economic concerns?
- Ambidexterity: did the participants strategically switch between different actions of opposition or resistance on the one hand and collaboration on the other hand, according to the position in which they found themselves in different moments of the process?
- Participation in decision making and implementation: to what extent each of the actors was involved in the decision making processes and how could this affect their willingness to implement agreements?
- Communication to constituencies and broader world: how can actors favor the necessary support for the agreements (or lack of it) with the others not directly involved in the multi-actor process (their constituencies, powerful actors whose support is needed for implementation of agreements, public opinion).

The learning insights are shared and discussed in a plenary session. In **Addendum 2** to this publication an elaborate set of concrete observations and questions to stimulate the reflection of the participants is presented. However, other tools for reflection

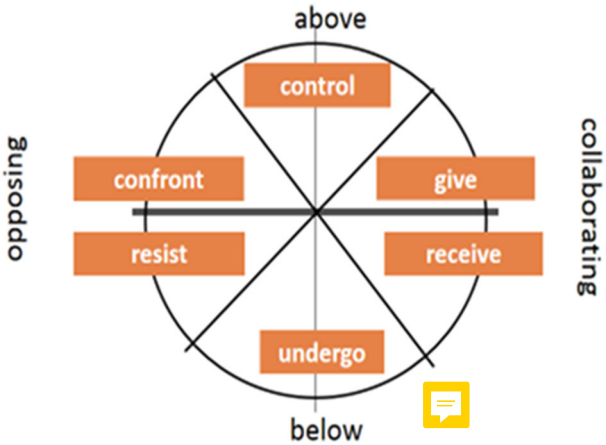

FIGURE 3 | Tool to reflect on ambidexterity between power plays and collaboration.

can possibly be applied as well, according to the learning objectives and core concepts of the course or training event in which the simulation takes place, and to the characteristics, interests, and expectations of the participants.

Individual Learning Reports

The participants are also invited to write an individual learning report (two pages approximately), based on the following questions:

- What did I see? (description of the course of events or interactions that most called your attention)
- What did I feel? (dominant emotions during the exercise, moments, and reasons that you were emotionally most involved)
- What did I think? (most striking learning conclusions, relevance of these new insights for your personal, and future professional life)
- Additional comments or reflections

The two first questions can best be answered as quickly as possible after the simulation, when memory is still fresh and emotions are vivid. The latter questions should be answered after the reflection session described in the former paragraph, and after reading some recommended relevant articles. They have to enrich the learning insights by linking them to the conceptual theories of these publications.

RESULTS

Empirical Data

Two main questions guide our analysis of the learning process with the "Mining in the Biosphere" simulation, to deal with complex sustainability challenges:

- How do the participants learn?

We are interested in which way and to what extent the participants experienced the experiential learning approach, implicit in the simulation, as helpful for their learning process. More specifically we want to know if the simulation can contribute to the embodied learning "with mind, heart and hands," which is called for in education for sustainable development (Gaffney and Kcenia O'Neil, 2018). We would also like to know if this way of learning helps the participants to transfer learning insights to their personal and professional life beyond the classroom.

- What do the participants learn?

We want to know if the participants refer to insights concerning the relational tasks that are considered important to deal with the ambiguity of complex sustainability challenges and to come up with innovative and inclusive action alternatives: connecting (stakeholder management, re-framing), confronting (power, ambidexterity) and committing (participation, communication).

The results presented here are based on the implementation of the "Mining in the Biosphere" simulation in three different educational contexts, namely in a training program for experienced scholars and professionals in sustainable development at the University of Cuenca, Ecuador (September 2015), in a course on Corporate Social Responsibility of a master program on international business management at the KU Leuven, Belgium (April 2017), and in a master of science program in water engineering at the University of Twente, The Netherlands (May 2017). Students differ among these three educational contexts, holding different educational backgrounds and professional experiences. Detailed information about the context, the learning objectives, the characteristics of the participants and the organization of the courses and the simulation in these three occasions can be found in **Addendum 2**. In **Addendum 3** we present a brief description of the main interventions of the different actors and of the critical interactions in the simulation executed in Cuenca, by way of illustration.

In each of the three simulations, four sources of information were used for the analysis: the results of the debriefing exercise ~~(Debriefing)~~, the group and plenary reflections based on the questions related to the relational tasks (in **Addendum 2**), the personal notes of the trainers (co-authors of this article) during the simulation and reflection exercises, and the written learning reports of the participants (an in-depth qualitative content analysis of these reports, delivered by 45 participants of KU Leuven and by 20 of Twente University, was done with support of NVivo by Jaenen (2019).

~~Results~~

How Do the Participants Learn: From Cognitive to Experiential Learning

"*When I see this kind of thing in the news on TV, I used to think that it's easy.... However, being involved in this simulation, I now know that it is not that easy to decide. I now can feel the dilemma, the hopelessness of the local communities, feeling weak compared to the huge mining company. There are other factors to consider too, such as employment, government earnings.*" (Student playing representative of Chamber of Commerce).

The participants realize the difference between the cognitive learning they are used to in their other classes and the experiential learning in the simulation. Although in all three cases, the participants received classes before the simulation about concepts that are important for dealing with sustainability like complexity, uncertainty, ambiguity, participation, collaborative processes, etc. it was only at the moment that they were put in the position of one of the actors confronted with a complex sustainability related challenge that they realized the deep implications of its wicked and ambiguous characteristics for their way of dealing with it. As one student at the University of Twente playing NGO-representative, expressed: "*The thought that was mostly present during the simulation was: have we learned nothing in the past few weeks? All the theories that we had, appeared not to be known by any of us.*"

After a little bit of hesitation in some participants at the start, they all identify quickly and intensively with the actors they represent in the simulation: "*At first, I was a bit confused with the things our group had to do and however naive it may seem, a little bit shy to talk to other groups about such serious stuff, keeping in mind that it is just a simulation. However, after I saw students' dedication and high involvement, and many "burning" eyes of young people, the negotiation process that was conducted among the groups dragged me so much that the simulation has suddenly become a reality*" (Student representing NPD).

The participants report rich reflections on their emotional involvement. This high degree of emotional involvement resulted in students improvising in their interactions with the others. A good example is the representative of the local community who told fictional but very realistic stories in the multilateral meeting about how families had been previously negatively affected by the economic activity of multinationals.

They express how the attitudes and actions of other actors really affected them emotionally, and they feel frustrated when they experience themselves trapped in a competitive action logic without the necessary empathy for the other actors to arrive at positive outcomes for all: "*We got trapped in a mainstream paradigm, where we easily lost touch with the issues related with the local community, the biosphere and sustainable development, concentrating in the financial and economic aspects of the negotiation. This lack of acknowledgment and empathy toward other parties created a level of frustration, which was further fueled by self-interest and egoism.*" (student representing Chamber of Commerce).

What Do the Participants Learn: Relational Learning for Sustainability Transformation

The participants were confronted with ambivalent feelings, attitudes and positions, toward other groups, internally in their own group and even within themselves. For instance, while running the simulation with the group in Ecuador, the community members tended to have a dual position toward the planned mining activities in their neighborhood. Many of them were in favor of these activities because of the expected economic benefits, yet they were very worried about their potential negative environmental and social repercussions. As a consequence of this situation, the participants experienced high emotional complexity, on one hand prompting discussions and conflicts with the other actor groups, and on the other to discussions and conflicts within their own group. The participants reported learning insights that were directly related to this situation, and expressed having learned to tolerate ambivalent feelings and the sometimes ambiguous position of the community, who encouraged mining, but at the same time was preoccupied with the consequences of it: "*I think I was emotionally most involved because there was a dead-end; we wanted to protect our community but we knew that even if we were refusing the offer, another company could come again offering less. Moreover, we had to decide by taking into consideration the reality, the facts and our human hunch [...] when we agreed to the idea that was a creation of multiple negotiation tours, the overall feeling of satisfaction was more dominant than the disappointment*" (student belonging to local community).

Participants also learned about social processes, and the value of being part of a group. *"I learned that a real team membership has to be based on collaboration and trust by giving credits to your team members and making them feel a real important part of the group."* (student playing NPD). Furthermore, they learned about the importance of setting group boundaries, and the significance of including or excluding actors from the conversations and negotiations. They realized first hand that when an actor enters or leaves a meeting, this may deeply change the content and the characteristics of relationships among all actors: "*What most called my attention in that experience happened when the NPD representative talked about this agreement during the second general discussion: all other stakeholders (especially the NGO and the local community) were angry that this agreement had only been discussed between the mining group and the NPD, and they were angry at the state agency. I think that this shows how important it is to involve public opinion and locals in the debate.*" (student representing the mining company).

More specifically, concerning power plays and the combination of empowerment strategies with collaboration for sustainability, the participants expressed several learning insights. They learned that actors need to be aware of their own power sources and responsibility over others, acting accordingly: *"I knew I had the most power of all, but I would not abuse it, I did not want the game to end in 5 min by excluding everyone I did not like from the process"* (*student playing N*PD). They have to analyze carefully the power distribution and power plays among the actors, to decide at any moment with whom and how they should interact preferably. Participants feeling dominated by the others learned that tactics to win time can be useful, and that they have to look for other actors as allies, e.g., the community inviting the press to give publicity to their cause. With these tactics they can become more empowered to enter the negotiations. They became aware of the importance of self-knowledge about (personal and organizational) limitations, e.g., "*The NGO with its outspoken pro-environment and anti-mining track record, became aware of its dependence on others, and changed its objective from opposing mining to requiring strict conditions for mining.*" When there is much pressure from powerful actors to arrive at quick decisions, participants representing weaker parties felt threatened and learned that

(temporarily) retiring from the multi-actor negotiation is an option.

Participants also acknowledged the potential of more powerful positions for constructive collaboration. They realized that actors can make use of their relative "outsider position," to mediate between the others and to recruit allies for a collaborative solution, e.g., "*The National Planning Department was aware of its power, and used it for a facilitator role.*" Conversely, the participants also observe the risk of "hidden communication channels" among the powerful actors to serve their own agenda e.g., between the mining company and the NPD, which may generate distrust among the other actors and undermine the collaboration.

DISCUSSION AND CONCLUSION: VALUE OF THE "MINING IN THE BIOSPHERE" SIMULATION AS AN EXPERIENTIAL LEARNING INSTRUMENT IN SUSTAINABILITY EDUCATION

In this work we have explored the use of behavioral simulations as a means to support experiential learning in multi-actor collaborations for sustainability. To this end, we developed a simulation based on a contested real case of mining in the Andes, which we tested in three different educational contexts. The simulation proved to be a multifaceted instrument for learning, not only able to link theory and practice in a classroom, but also to fit at different educational levels, e.g., traineeships, or academic curriculums. Based on our experience, we believe that such a tool constitutes a suitable and effective complement to a regular course curriculum as well as to an extra-curricular professional training program to learn about relational tasks and collaborative processes for sustainable development.

In the simulation exercises we carried out, students demonstrated an increased awareness of the importance of the relations among actors to deal adequately with the wicked nature of the simulated case. As one of the students from the International Business program expressed: "*Being the representative of the National Planning Department was one of the best experiences I have had [. . .] so far. I had never performed negotiations, so I was a little anxious at the beginning. I realized during the town hall meetings that I love negotiating, finding compromises and seeking solutions. I never thought that I wanted to be the person that tried to find common ground between multiple actors. This class was a real eye opener for me.*"

At the end of the 10 days interactive training course at the University of Cuenca, the participants who were experienced professionals and academics in sustainability, rated the simulation exercise as the most appreciated methodology (in an individual, written, anonymous evaluation), because of the vivid involvement and possibilities to translate the learning conclusions to their own situations. This indicates the potential value of the simulation for emotional and embodied learning which is needed to transform our societies toward a sustainable future.

Although it is not the intention of the simulation to mimic or predict the future course of the events in reality (which is still ongoing) but to explore and learn about various action alternatives, the local co-trainer and facilitator of the simulation, informed in a mail ~~1~~ year later that the similarities between what happened in the simulation and what is going on in reality, is striking. This confirms the high level of realism, not only of the simulation scenario, but also of the way the participants are able to learn about group dynamics during collaborative processes, identify with their actor groups and behave accordingly. The local facilitator indicated also that the analysis of the simulation helped him in the real practice of the case, to combine and balance the different, apparently contradictory roles and functions, as representative of a local NGO.

An important part of a simulation exercise is devoted to reflection about the experience participants had at the individual and group level. To this end, the simulation incorporates tools for reflection and analysis that are helpful for stimulating learning processes, where students can learn from their own experience. Central to the effective application of these tools is the role of the facilitator, that is not restricted to "facilitate the game", but also encompasses stimulating creativity and reflection in a group. As such, the facilitator must be capable of asking the right questions, bringing supportive conceptual frameworks and theories into the exercise, and providing opportunities and ideas for participants to experiment with sustainable alternative behaviors and practices.

All in all, the simulation proved to be a versatile teaching tool, capable of enabling learning opportunities at different educational levels and contexts. Part of its effectiveness is that it balances adequate levels of *realism*, so students could easily engage and relate to it, of *abstraction,* being open to accommodate the different realities students bring; *complexity*, allowing for the emergence of dynamics and situations that are challenging and fun to address and play. We had the unique opportunity of running the simulation in three disparate educational environments, with participants having distinct cultural and educational backgrounds, including academia and practice. While all instances were different, each of them became a learning experience for both those that participated and for us, as facilitators. In our experience, this behavioral simulation constitutes a space for safe learning, a laboratory for embodying and practicing collaboration. A learning opportunity able to closely mirror real life.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for

participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/frsus.2021.694313/full#supplementary-material

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