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Varone, Sophie; Szilas, Nicolas

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The future of the world: from scientific account to interactive storytelling

Sophie Varone[0000-0002-7725-5920] and Nicolas Szilas[0000-0002-4565-8805]

TECFA, FPSE, University of Geneva, Bd du Pont-d'Arve 40, CH 1211 Genève 4, Switzerland

sophie.varone@etu.unige.ch, nicolas.szilas@unige.ch

Abstract. Starting from the observation that a cognitive distance prevents human beings from taking the measure of the current climate crisis and adopting adequate behaviors, this article asks the question to what extent a narrative approach could help to reduce it. First, it proposes a narratological analysis of some of the scenarios of the future of the world outlined by the scientific community, the Shared Socio-economic Pathways, which leads to the conclusion that, despite the terminology used in the associated commentaries, these scenarios have little narrative value. Continuing with a questioning of the difficulties and implications of the conception of a narrative about the future, it then shows how the approach of anticipation narratives, which consist in envisioning tomorrow on the basis of choices made today, naturally approaches that of interactive narrative. Finally, it argues that transforming the scientific scenario into a fully-fledged narrative cannot be done without adding fictional elements which, if they are coherent and plausible, can only enrich it and sharpen its didactic impact.

Keywords: Anticipation, Future, Narrative, Interactive narrative, Scientific scenarios, Shared Socio-economic Pathways, Degree of narrativity, Climate crisis, Environment, Ecology.

1 Introduction

Numerous studies have examined the question of why human beings, now that they are informed and aware of the threat of climate change, show so much resistance to adopting more environmentally friendly behavior. The avenues often evoked to explain this psychological barrier relate in particular to the distance that separates us from the consequences of global warming, whether it be temporal, geographical, socio-cultural, or the uncertain nature of the future [12]. This distance can also be explained by the fact that the information available to understand the ecological crisis, the information conveyed by the scientific community in particular, is not always accessible to a public lacking in expertise. The data from studies carried out by climate scientists or environmental specialists are often transmitted in highly specialized jargon or in a format that may be hard to understand, such as the sixth report of the IPCC[1] and its several thousand pages.[2] Although attempts to popularize these complex issues are becoming more and more numerous and are aimed at an increasingly varied public (press articles, educational sheets, transition support kits, etc.), the ins and outs of the crisis have not yet penetrated all strata of society, partly because of this lack of clarity.

Reducing this distance may involve "bringing the future mentally closer", to use Markman's expression [12]. This undertaking consists in making tomorrow more tangible, both by thinking about it today and by reducing the degree of complexity with which it is understood by those who hold the scientific keys. This article starts

[1] Intergovernmental Panel on Climate Change.

[2] See IPCC website, accessed on July 25, 2022. https://www.ipcc.ch/report/ar6/wg2/.

from the hypothesis that interactive storytelling could contribute to this and, after formulating this postulate, it raises the question of what would be the nature of such a narrative as well as its implications on the narratological level.

First, we will look at the way the scientific community tells the future of the world through some of the possible scenarios it proposes. These scenarios will then be analyzed from a narratological point of view in order to evaluate their degree of narrativity, after which the implications linked to the conception of a plausible and believable interactive anticipation narrative will be highlighted.

2 The scientific account of the future of the world

Narratives about the future are no longer the prerogative of literary genres such as science fiction or climate fiction. The rigorous and methodical scientific community itself is infiltrating the sphere of the humanities, or at least borrowing its vocabulary, in order to offer us its own scenarios. The future of the world, as perceived by the so-called hard sciences, takes the form of acronyms that may seem opaque to an uninformed public: RCPs and SSPs, respectively Representative Concentration Pathways and Shared Socio-economic Pathways in their extended form. Developed by two groups of experts from the climate change research community, these acronyms and their definitions are the result of a process that aims to draw the possible evolution of the world and society by the end of the century on the basis of documented scientific data. This process integrates two types of prospective research leading respectively to two types of scenario. The first one focuses on the atmospheric concentration of the main greenhouse gases and selects five possible climate evolution trajectories between now and the end of the century. These trajectories are summarized in what scientists call Representative Concentration Pathways (RCPs). At the same time, a second group of researchers is more specifically interested in the socio-economic evolution of society and proposes five Shared Socio-economic Pathways (SSPs) [17]. Defined as socio-economic development trajectories based on possible changes in the world [19], the SSPs were developed with a view to providing a common framework for thinking about the analysis of climate change impacts, its possible mitigation and the adaptation of species, the human species in particular. There are also five of them, describing trends in technological, economic, political, and social change that could occur by the end of the century and their potential impact in terms of demographic change (population growth, mortality, fertility, migration, level and type of urbanization) and human development (education, health, equality, social cohesion and participation) [17].

The SSPs describe societal models in which sustainable development and fossil fuel consumption have varying degrees of importance, different geopolitical situations, different levels of environmental degradation, and different conditions and lifestyles. Their summaries [19] are presented below.

Table 1. Summaries of the five Shared Socio-economic Pathways

SSP1	**Sustainability - Taking the Green Road (Low challenges to mitigation and adaptation)** The world shifts gradually, but pervasively, toward a more sustainable path, emphasizing more inclusive development that respects perceived environmental boundaries. Management of the global commons slowly improves, educational and health investments accelerate the demographic transition, and the emphasis on economic growth shifts toward a broader emphasis on human well-being. Driven by an increasing commitment to achieving development goals, inequality is reduced both across and within countries. Consumption is oriented toward low material growth and lower resource and energy intensity.
SSP2	**Middle of the Road (Medium challenges to mitigation and adaptation)**

	The world follows a path in which social, economic, and technological trends do not shift markedly from historical patterns. Development and income growth proceeds unevenly, with some countries making relatively good progress while others fall short of expectations. Global and national institutions work toward but make slow progress in achieving sustainable development goals. Environmental systems experience degradation, although there are some improvements and overall the intensity of resource and energy use declines. Global population growth is moderate and levels off in the second half of the century. Income inequality persists or improves only slowly and challenges to reducing vulnerability to societal and environmental changes remain.
SSP3	**Regional Rivalry - A Rocky Road (High challenges to mitigation and adaptation)** A resurgent nationalism, concerns about competitiveness and security, and regional conflicts push countries to increasingly focus on domestic or, at most, regional issues. Policies shift over time to become increasingly oriented toward national and regional security issues. Countries focus on achieving energy and food security goals within their own regions at the expense of broader-based development. Investments in education and technological development decline. Economic development is slow, consumption is material-intensive, and inequalities persist or worsen over time. Population growth is low in industrialized and high in developing countries. A low international priority for addressing environmental concerns leads to strong environmental degradation in some regions.
SSP4	**Inequality - A Road Divided (Low challenges to mitigation, high challenges to adaptation)** Highly unequal investments in human capital, combined with increasing disparities in economic opportunity and political power, lead to increasing inequalities and stratification both across and within countries. Over time, a gap widens between an internationally-connected society that contributes to knowledge- and capital-intensive sectors of the global economy, and a fragmented collection of lower-income, poorly educated societies that work in a labor intensive, low-tech economy. Social cohesion degrades and conflict and unrest become increasingly common. Technology development is high in the high-tech economy and sectors. The globally connected energy sector diversifies, with investments in both carbon-intensive fuels like coal and unconventional oil, but also low-carbon energy sources. Environmental policies focus on local issues around middle and high income areas.
SSP5	**Fossil-fueled Development - Taking the Highway (High challenges to mitigation, low challenges to adaptation)** This world places increasing faith in competitive markets, innovation and participatory societies to produce rapid technological progress and development of human capital as the path to sustainable development. Global markets are increasingly integrated. There are also strong investments in health, education, and institutions to enhance human and social capital. At the same time, the push for economic and social development is coupled with the exploitation of abundant fossil fuel resources and the adoption of resource and energy intensive lifestyles around the world. All these factors lead to rapid growth of the global economy, while global population peaks and declines in the 21st century. Local environmental problems like air pollution are successfully managed. There is faith in the ability to effectively manage social and ecological systems, including by geo-engineering if necessary.

3 Shared Socio-economic Pathways, terminology and degree of narrativity

3.1 Terminological considerations

While modelling the evolution of greenhouse gas emissions and their impact on climate may seem remote from the topics of interest of the humanities and social sciences, modelling societal factors such as the evolution of economic or political paradigms is much less so. This is all the more true when the vocabulary describing them fits so well with that used by specialists in narratology. In the whole literature associated to the Shared Socio-economic Pathways, the word 'Scenario' is indeed used to name them, while 'Narrative' designates their short descriptions [17, 19]. The terms 'pathway', 'scenario' and 'narrative' therefore merit some initial explanation.

As we define 'pathway' as the trajectory followed by an entity in motion, the SSPs seem to inscribe future social and economic changes in a form of 'narrative' that uses the concepts of 'scenario'. The term 'scenario' should be interpreted here in the broad sense of the expected or assumed development of an action over time, a sense very close to that of pathway. The specific meaning given to it by the field of social sciences, i.e. "a strategic and methodical study which uses multiples data to consider various hypotheses and possible decisions" [8],[3] also suits it quite well. Considering each SSP as a 'narrative' invites us however to understand this term in its more widespread cinematic sense.

Starting from a scientific vision of the future of the world, the SSPs are thus presented and discussed using a terminology familiar to narratologists. The question then arises as to the extent to which they possess the characteristics of narrative as understood from a narratological point of view. In other words, we ask ourselves, in the rest of this article, if these SSPs are likely to inspire scenarios of the future of the world in the sense that they are understood in cinema, literature or video games, i.e. scenarios that could take these methodical and plausible forecasts of the future beyond the restricted circles in which they are conceived or for which they are intended, to reach, and perhaps touch, a general public that is too often held back in its projections, especially when these are linked to the environmental crisis. To put it another way, scenarios that could make the consequences of global warming more tangible and generate a reflection on a longer-term future that remains worrying.

3.2. The degree of narrativity of the SSPs

Beyond the terminology used to name and define them, can we really consider the 'narratives' of SSPs as fully-fledged narratives? Prince [18] defines a narrative as "the representation (…) of one or more real or fictive events communicated by one, two or several (…) narrators to one, two or several (…) narratees".

Ryan [21] proposes evaluating the degree of narrativity through a framework including eight conditions grouped under four dimensions presented below:

Table 2. Ryan's Evaluation framework

Spatial dimension	a. Narrative must be about a world populated by individuated existents
Temporal dimension	b. this world must be situated in time and undergo significant transformations c. the transformations must be caused by non-habitual physical events
Mental dimension	d. some of the participants in the events must be intelligent agents who have a mental life and react emotionally to the states of the world e. some of the events must be purposeful actions by these agents
Formal and pragmatic dimension	f. the sequence of events must form a unified causal chain and lead to closure

[3] Our translation.

	g. the occurrence of at least some of the events must be asserted as fact for the storyworld h. the story must communicate something meaningful to the audience

Evaluating the degree of narrativity of the SSPs through this framework will not lead to an irrefutable conclusion since, in the words of its author, it leaves each one to a fairly wide range of interpretation. However, if we sift through the SSP scenarios on each of these points, a number of problems arise. First, the spatial dimension (a) would be one of the most controversial points. In the commentary associated with this condition, Ryan [21] states that it excludes representations of abstract entities and whole classes of concrete objects, scenarios involving 'humankind', 'reason', 'the state', etc. From our point of view, since the human race is made up of individuated existences and states can be easily personified, the narratives of SSPs partly fulfill this first condition. Only partly, because the interpretation of this notion of individuated existences also depends on the degree of individuality of the entities considered. Concepts such as 'a population', 'an institution', 'a country' or 'an organization' (e.g. TotalEnergies) can indeed be perceived as 'individuated existences', but they are all at different degrees including different levels of concreteness. The temporal dimension is also open to discussion, since while the SSPs are indeed situated in a time frame that extends from the present to the end of the century, the significant transformations mentioned in (b) are not clearly defined. When SSP1, for example, refers to the fact that "the world shifts toward a more sustainable path" or "broader emphasis on human well-being", SSP2 to "the intensity of resource and energy use declines", or SSP3 to "countries (…) focus on domestic or, at most, regional issues", it is difficult to imagine how these significant transformations are actually occurring. While the areas in which they take place, such as development, energy consumption or domestic and foreign policies, are clearly inferred from this kind of formulation, the concrete measures envisaged to make these changes happen are completely elided in the short descriptions of the SSPs. The same type of remark also applies to (c), the unusual physical events causing the significant transformations mentioned in (b). In the context of the climate crisis, we can imagine that these are linked to the damage caused to the environment by the increase in temperature (heat waves, drought, rising water levels, etc.). The consequences of these phenomena, such as the migration of climate refugees, the increase in the population of cities beyond their capacity, a potential water war, etc., are however not mentioned in the SSPs.

The mental dimension, which includes conditions (d) and (e) according to which some of the protagonists are intelligent agents capable of reacting emotionally to events or states of the world which are sometimes deliberately provoked by them, is completely absent from the SSPs. The way in which individuals are emotionally affected by the changes in the world, in other words the psychological impact of the ecological crisis (eco-anxiety, anger, revolt, denial, etc.), does not show up at all in their narratives. Nor do the actions deliberately undertaken by individuals to provoke the events.

Conditions (f), (g) and (h) included in the pragmatic and formal dimension of the framework are less problematic. The fact that some of the events are factual to the world of the story (g) as well as the fact that the story communicates something meaningful to the audience (h) are hardly refutable. On the other hand, condition (f) that the set of events must form a unified causal chain is not at all obvious. The only major cause that produces all the effects represented in the states of the world described in each of the scenarios is the environmental crisis. However, it seems that a number of elements have been overlooked in order to be able to move logically from a cause such as 'the human species is facing a major ecological crisis' to effects such as "resurgent nationalism" or "increasing inequalities and stratification both across and within countries" evoked respectively in SSP 3 and 4.

To conclude this analysis, if we stick to a relatively simple definition, such as the one proposed by Prince [18], it is difficult not to consider the narratives of SSPs as true narratives. Nevertheless, when envisaged through Ryan's [21] more complex

evaluation framework, their degree of narrativity remains quite low, even though these scenarios fulfill some of the conditions included in the model.

The question that then arises is how to rewrite these SSPs in such a way as to transform them into a fully-fledged narrative that would be both informative and motivating. In other words, into a narrative that would both retain the scientific relevance on which the SSP scenarios are based and, in so doing, make the narratee's perception of the ecological crisis more accurate and tangible, while at the same time having a sufficiently strong impact to encourage climate action. Avenues for addressing this question may emerge from the interactive narrative discussed in Part 5. Before discussing this topic, the following paragraph raises the question of the nature of the difficulties induced by a narration about the future. As Liveley [10] indeed asks: "By better understanding the ways in which such prospective reading and narrative anticipation works, then, might we better appreciate the subtleties and processes of anticipation in both story worlds and real world scenarios? Could narratological insights into the operations of anticipation offer useful insights into the way we read stories about the future?".

4 Telling the future, what difficulties, what implications?

The process of rewriting the SSPs involves design challenges that, for the most part, are similar to any act of story creation. To put it simply, it is necessary to ask who the protagonists are, in what space-time they evolve, what events to include, what narrative processes to use and what message the narrative delivers and to whom. Each of these questions depends first of all on the nature of the relationship that links the real world to the narrative world. The prospective nature of a narrative about the future, however, induces a mode of narration that differs from that of narratives about the past or the present. This paragraph examines these different questions.

The events narrated in a future story have not yet taken place, so the factual elements are non-existent. The world of the narrative is purely virtual and all the assertions of a future narrative have only an indeterminate truth value at the moment of enunciation. The semantic distinction between fact, negative fact and possibility remains, but these three categories are subject to the 'possibly' operator [11]. From an epistemic point of view, this poses a major problem. Any scenario about the future of the world, even if conceived on the basis of attested scientific data and using methodologically proven models, can only be speculative.

Margolin [11] distinguishes four modalities of future narratives. According to him, the narrative can be in a doxastic register "there will be...", where the speaker believes that what he is recounting will happen; hypothetical, when only the assertion that certain possibilities exist is formulated "it may happen...", optative when he wishes that the events of the narrative will happen "may it happen to you..." or deontic when he imposes obligations on the recipient of his narrative "do this and it will happen..." [11]. The first two modalities are epistemological in nature; they enable certainties or probabilities to be stated. The third and fourth are more ethical in nature. The things we wish to see happen imply a value judgment as to what we consider desirable. Obligation, which belongs to the imperative mode, is related to the philosophy of action, whose link with ethics is undeniable. The SSP project is a scientific one, so it is not surprising that we do not find any formula in the SSPs that is optative or deontic. We can, however, still envisage in the context of a rewriting of these narratives, that they integrate elements that would highlight their underlying values or their ethical implications. When SSP1 mentions, for example, "a broader emphasis on human well-being", we need to be clear about what 'human well-being' means. Even if the issues surrounding the future of the world were to raise profound ethical questions, the SSPs are inscribed in the field of knowledge. More precisely they are anchored in the sphere of what is possible, thus in a hypothetical register, the future being by nature uncertain.

This hypothetical status anchors the different worlds described in the scenarios in the discussion of 'possible worlds' which, from Leibniz through the logicians of the second half of the twentieth century, has finally infiltrated the universe of narratology.

From a narratological point of view, in the analysis of Ryan [20] especially, the concepts of Actual World (AW), i.e. the real world, and of Textual Actual World (TAW), i.e. the world formed by the facts presented as actual by the narrative, are central. According to Ryan's [20] principle of 'minimal departure', we reconstruct the world of the narrative in such a way that it is as close as possible to the real world, and this remains true in the case of a narrative about the future until an event shatters our familiar representation of the world.

Moreover, anticipation narratives place their audience in front of a narrative prolepsis, that is to say in front of what Prince [18] defines as "an anachrony going forward with respect to the 'present' moment". It seems then, according to these narratological considerations, that the human mind projects itself into a narrative context concerning the future without getting rid of the filter through which it perceives and interprets the present world, built in part on the way it perceives and interprets its past experience. The cognitive processing of anticipation thus involves a complex interaction between the past, the present and the future [10] essentially built on what is familiar to the narratee.

From this point of view, SSPs are not contradictory to such a cognitive process since they are designed in such a way as to preserve what Ryan [20] calls the identity of the inventory between the present textual world and the actual world, namely the fact that the world of the narrative is composed of the same objects as the real world. This inventory identity is indeed maintained in the scenarios, as they make no mention of specific objects or technologies that do not currently exist in the actual world but would appear in the textual actual world. Expressions such as "there is faith in the ability to effectively manage social and ecological systems, including by geo-engineering if necessary" or "local environmental problems like air pollution are successfully managed", for example in SSP5, only suggest that the inventory of objects is not exactly the same in the two worlds, what we can easily understand in the context of the SSPs. It is indeed impossible to speak about the nature of objects, technologies, geopolitics or some paradigm of a future world without getting lost in conjectures that would instantly render any scientific approach vain.

The question of characters in the case of prospective scenarios, whether they are individuals, governments, groups of governments or organizations, poses the same type of problem. How can we anticipate the events, the conditions of life or the type of relationships that would be experienced by protagonists who have not yet been born or whose nature, boundaries, or even mission or status, would be likely to change?

It seems, therefore, that it is the prospective nature of narratives about the future that condemns them to confine themselves to a known world if they wish to retain their plausibility and verisimilitude. The narrative of a world to come, by nature hypothetical from a scientific point of view, must cling to what is factual in the present world; to break this principle is to assume the metamorphosis of a simple anticipation narrative into a science- or climate-fiction scenario. This point explains, on the one hand, the little room left for the emergence of novelty in the narratives of SSPs, and on the other hand, their highly generalizing character which weakens their narrative nature.

However, in following Ryan's insight that 'Living a narrative prospectively means (…) trying to anticipate possible developments, and experiencing the disappearance of possibilities (…) but remaining steadily focused on the hatching of the future' [10], departing from scientific methodology to allow creativity to express itself may make sense in a process of rewriting SSPs.

5 From multiple scenarios to interactive storytelling

Although not directly related to SSPs, numerous video games are based on ecology or environmental crisis. Examples include: *Eco* [4], a game in which players collaborate to create a civilization on a virtual planet; *The Sims4: Eco Lifestyle* [23], where they are encouraged to adopt environmentally friendly behaviors; *Fate of the World* [6], a turn-based strategy game in which users must manage the resources available to an ever-growing population in the context of global warming; *Civilization VI: Gathering*

Storm [3], which incorporates natural disasters related to climate change, *The Climate Game* [24], whose goal is to reach 'net zero' by 2050 by answering multiple choice questions, and *Walden a game* [27], which offers to relive the experience of the philosopher Henry David Thoreau when he chose to settle in the woods for more than two years and subsist only on the resources offered by nature. The last one differs from the others in the sense that it is not based on anticipation, since it relates events that took place in the 19th century. However, it is the game that best integrates the narrative dimension, which is at the heart of this article, a fact that is not so surprising since the game is directly inspired by two major works by Thoreau, *Walden: or Life in the Woods* [25] and his *Journal* [26]. All the others, with the exception of *The Climate Game* whose game mechanics follow a question/answer logic, are strategy games, management games or simulation games, genres that certainly include some elements specific to the narrative, but which cannot be assimilated to narrative games. However, the project, which we describe here, which consists in using SSPs to design an interactive narrative would follow an inverted scheme, that is to say a narrative game integrating some management and simulation elements.

To return to the SSPs, the fact that the scientific experts propose from the outset not one but five scenarios, is central to the approach. This set of scenarios is there to signify the presence of different possible futures, and one can thus consider this set as a large multi-linear scenario, which presents several parallel temporal trajectories, in the manner of films such as *Groundhog Day*, *Run Lola Run* or *Smoking/No Smoking*. Multi-linear narratives can be of several types. In the case of the SSP narratives, the five scenarios correspond to five alternative realities, five possible worlds, whose supposed future actualization depends, at least in part, on the actions taken by society. The situation is similar in the films shown as examples above. The creation of an alternative depends on the choices made by certain characters in the story, by branching off from a "mother" variant. These choices are rather implicit in the summarized scenarios that are given to us. For example, scenario SSP4 states: "Environmental policies focus on local issues around middle and high income areas". Faced with such a scenario structure, a transition to interactivity occurs naturally: the choices that make it possible to move from one scenario to another can be taken by the reader-user himself (the player), who becomes, through his participation, "responsible" for the evolution of the projected world. With only five initial scenarios, the material for a new interactive scenario is certainly limited but the addition of interactivity at the level of character choices, as proposed by many video games[4] as well as research on interactive drama [1, 13, 22, 28] seems a relevant way to explore possible futures. The potential benefits of this interactivity are:

- A stronger impact, as we move from passive to active pedagogy and as a higher level of agency, defined by Murray [15] as “the satisfying power to take meaningful action and see the results of our decisions and choices”, may indeed increase the perception and awareness of the future consequences of our current choices.
- Simpler content exploration: simply reading the multiple scenarios requires a significant cognitive effort since it requires the reader to compare point by point the differences between scenarios and the causes of those differences.
- A more adequate way than traditional narratives to represent the complexity of our reality [9] insofar as it allows to gather in a single story very different scenarios, sometimes absolutely opposite, which is not so easy in a traditional story.

What is the impact of this interactivity on the nature of the possible worlds generated by the narrative? As discussed above, the possible worlds generated by the SSPs are of a hypothetical type. In the interactive case, the status of the possible world generated by the user’s participation may change. One can certainly see this participation simply as a neutral exploration of possible futures. But the action of the user is not neutral, it expresses a global intention, depending on the style of play that the player adopts. For example, we can a priori assume that the user’s action is

[4] Adventure games, Role-Playing games, life simulators, etc.

motivated by his desire to do his best to "save the world", to bring global warming under control. From this point of view, "winning the game" means achieving a scenario close to the SSP1, and the possible world generated can be described as optative, according to Margolin's terminology [11]. The opposite case (not winning the game) would be an "anti-optative" world. But the player can adopt a completely different attitude, familiar to role-players: playing a character that is not oneself, stepping outside one's own identity to project oneself into another character, even one that is very far from oneself. For example, a user might decide to play the role of a large oil company and defend the interests of that company. In this case, the possible world is no longer on the optative register but more hypothetical. In all cases, the addition of interactivity emotionally enriches the link between the receiver of the scenarios and the possible worlds that are generated during the narrative experience.

We must however conclude this chapter by specifying that if interactivity can potentially improve the reception of SSPs in a significant way, some experiments [5, 7] could not verify the hypotheses according to which it can greatly improve the comprehension of a given situation, the curiosity or the feeling of mastery, and thus of control, of the users. However, these same studies mention the fact that technical problems that occurred during the experimentation process, as well as excessive ergonomic or functional complexity, may have influenced the users in the same way as the interactivity of the tool that was the object of the experimentation. Moreover, the experiment described in McQuiggan et al. [14] suggests that if the learning gain in a narrative-based environment is not superior of that of traditional instructional approaches, it seems to have a significant impact on motivation, especially through a higher level of presence, a fact whose importance should not be overlooked in the context of behavioral changes induced by the climate crisis.

6 Filling the gaps

Regardless of the underlying technology, interactive storytelling requires a significant amount of content, which the SSPs presented above fall far short of providing. Therefore, "making it interactive" requires filling in the gaps, on several levels.

On the one hand, as mentioned above, five scenarios, i.e. five possible states, do not open up many choices: at most three, in a simple narrative with diverging branches (with no return to the other branches).[5] This limitation can certainly be overcome if we consider that the SSPs are only the tip of the iceberg: the data are very extensive, and refer to numerous scenarios developed by scientists. Moreover, these scenarios are derived from simulation models that can be used (in a simplified way) in the interactive narrative, to provide not discrete but continuous scenarios.

On the other hand, a characteristic of the SSPs noted in Section 3 is the lack of concrete characters. Adapting these scripts for the "interactive storytelling" format will therefore require the insertion of characters: character-entities (e.g., a country), characters representing an entity (e.g., a president), or characters in society, whose fate illustrates the globality of society. This is a fairly standard procedure in docu-dramas.

Finally, the actions themselves undertaken by these characters have not necessarily all been documented by scientific studies. The need to create a coherent and engaging narrative may lead the authors of the story to add content to make the whole thing acceptable. The situation is analogous to interactive educational narratives that seek to reproduce a real situation in a credible way (e.g. FearNot! [2] or Nothing For Dinner [16]). These stories are based on real testimonies, which makes them similar to documentaries, but at the same time they have to create situations, which makes them closer to fiction. The fictional elements added should not transform the factual elements, and become counterfactual, but enrich the story in a coherent, plausible way. Too much use of fiction risks becoming manipulative, and can lead to controversy.[6] For the stories of the future, it is therefore a question, in the same way, of fleshing out

[5] A 3-choice branching story gives 8 possible endings.

[6] See, for example, the debates around the mini-series *Chernobyl*, released in 2019.

the scientific data, without dissolving them into a purely imaginative science fiction. The symmetry between documentary narratives and scientific narratives of the future is not perfect, however, as explained above, the trajectories traced by the SSPs are not facts, as are historical facts, they are just anticipations in accordance with the scientific knowledge of the moment. A documentary untruth is easy to detect for an expert in the field but a "counterpossibility" is more delicate to detect. As far as the future is concerned, everything is situated in a hypothetical register, and therefore fictional.

7 Conclusion

Through this analysis of the future of the world scenarios delivered by the scientific community via the Shared Socio-economic Pathways, which are qualified as narratives according to the terminology used in the comments that accompany them, this article has attempted to show how their degree of narrativity is, all in all, too weak to consider them as full-fledged narratives. While all the elements of narrative (space, time, characters, transformative events, causal chain and outcome) are present, at least in an underlying or inferred way, the respective descriptions of these scenarios remain too generalized to have an impact similar to that of stories, whatever their nature. Moreover, the prospective nature of all forms of narration about the future places the events described in a register that is only speculative and not factual. This distances us from the scientific approach since the object considered is only hypothetical. These anticipation narratives[7] have however, because of their scientific character, a potential that remains interesting to exploit within the framework of the conception of a real storytelling, notably in an interactive storytelling. Furthermore, the fact that the SSPs present in such an implicit way the choices made today in order to outline five possible futures places the reader in a position where he or she is forced to make multiple inferences from the current world to the world of tomorrow, i.e. in a process of reflection that is itself interactive. As we have seen, using the content of the SSPs in the framework of an interactive narrative would also convey a greater impact as well as a richer exploration, even understanding, of the scientific material transmitted. Such an undertaking would however imply the addition of content that would move away from what science can legitimately affirm today. If these additional fictional elements were to enrich such a narrative in a coherent and plausible way, it could nonetheless contribute to a more generalized awareness of the ecological crisis and reduce the distance that separates us from the consequences of global warming.

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[7] Let us keep the term since, despite our conclusion, it is the one used in the reports that concern them.

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