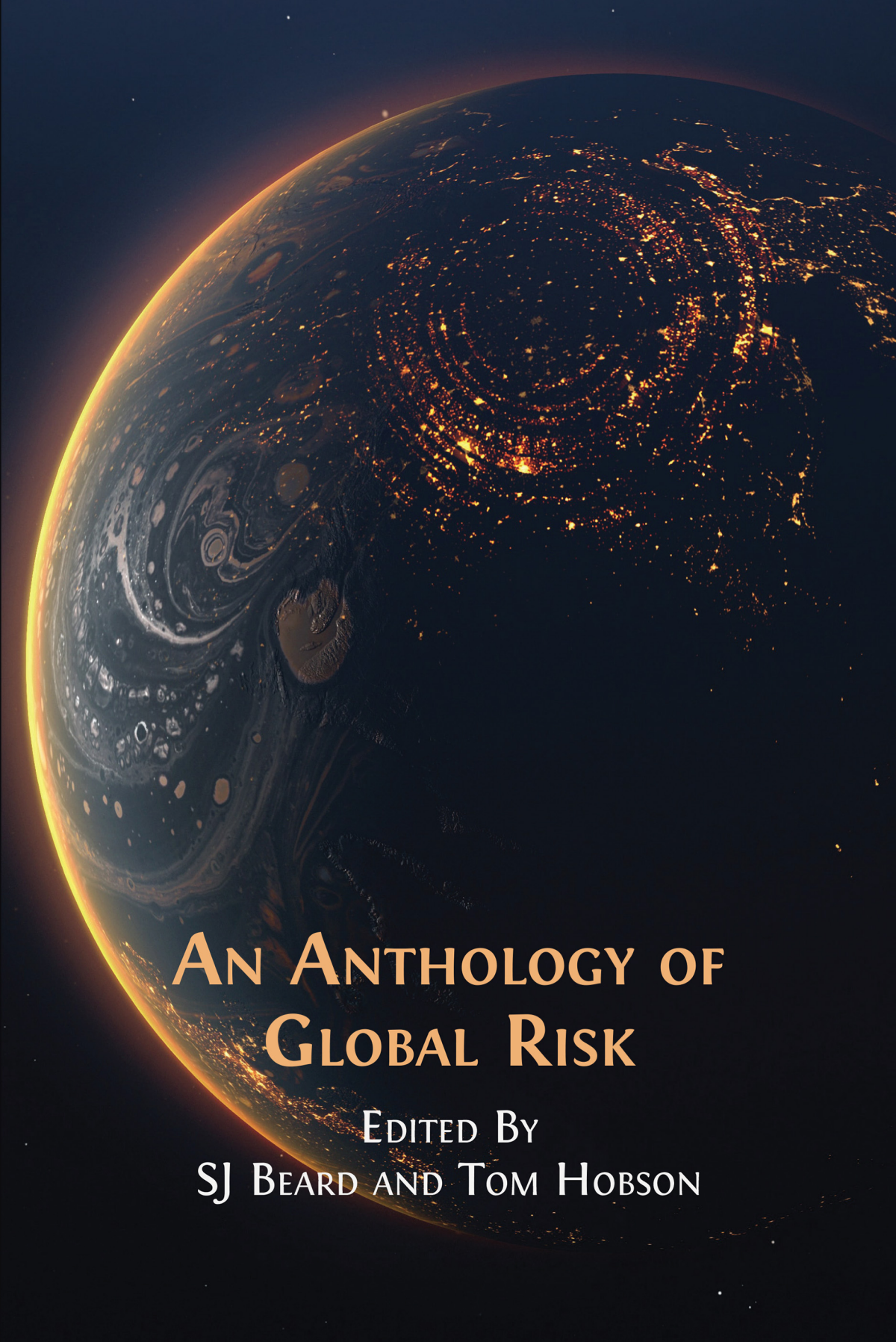

An Anthology of Global Risk

Edited By

SJ Beard and Tom Hobson

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11. Enabling the Participatory Exploration of Alternative Futures With ParEvo

Rick Davies, SJ Beard, Tom Hobson and Lara Mani

Highlights:

- ParEvo is an online method of developing alternative future scenarios using a participatory evolutionary process. This involves the reiteration of variation, selection, and reproduction of possibilities, i.e. an embodiment of the evolutionary algorithm.[1]
- The process is designed to be used by multiple people to produce a collective good — a set of storylines. In addition, the process generates data on the structure of participation — how people have collaborated to produce those storylines.
- For users, ParEvo can achieve two related purposes. The first is cognitive: to enable participants to creatively think about alternative futures and to prompt how they do that thinking (metacognition). The second is more behavioural: to prompt consideration of ways of responding to possible futures, in anticipation and/or in response, and to exploit and/or mitigate their consequences.

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- This chapter explored the origins and use of ParEvo and illustrates how it has been implemented and analysed. Illustrative references are made to two recent exercises carried out by CSER.
- Three types of evaluation challenges are highlighted, concerning the performance of individual participants, exercises, and the platform as a whole. Researchers are invited to explore the uses of the application and to address some of the challenges raised in this chapter.

Exploring possible alternative futures is an invaluable means for thinking about how risks and vulnerabilities might develop, and how they may be mitigated. At the same time, this type of collaborative, exploratory futuring exercise is also useful for illustrating that, while some path-dependencies should be attended to, catastrophic (or utopian) visions of the future are not ineluctable or inevitable — change always remains possible and pathways to a safer, more survivable future can always be taken. The opening up of these possibilities is explored, in a rather different way, in Chapter 21, while alternative means of exploring futures collaboratively are proposed in Chapters 8 and 15.

The Origins of ParEvo

The design of the ParEvo process had its origins in the lead author's 1998 PhD thesis on organisational learning within non-governmental aid agencies (NGOs). That conception of organisational learning was based on an evolutionary epistemology.[2] The same research led to the design of another method also using a social embodiment of the evolutionary algorithm known as Most Significant Change (MSC).[3] Now used widely for impact monitoring and evaluation in complex development projects,[4] MSC is a convergent and optimising process in contrast to ParEvo which is more divergent and satisficing.[5]

Uses to Date

As of mid-2022, 19 different ParEvo exercises have been completed, during and since the development of the web application.[6] Participants

have included school students, volunteers recruited from evaluation communities of practice, crowdsourced paid adult university educated UK participants, staff from a UK development aid think tank, UN Volunteers, UN agency staff members, and internationally recognised experts in particular fields. Futures explored include post-Brexit Britain, climate change post-COP26, post-Trump USA, a five-year corporate strategy, uptake pathways for educational research, the global governance of biotechnology research risks, and the future of Existential Risk Studies. Alternative histories have also been explored, including agricultural development project implementation, UNV volunteer experiences, and gender policy implementation within a UN agency. Eight of the earlier exercises were initiated by the lead author; 11 of the more recent exercises were initiated by members of other interested organisations. Two of these were implemented by the Centre for the Study of Existential Risk (CSER), in Cambridge, UK, and have been used as illustrative examples. Four other exercises are now scheduled for 2022–2023.

How a ParEvo Exercise Works

3.1 The generation of storylines

Via an online interface at ParEvo.org, participants are presented with a seed text equivalent to the first paragraph of a novel. This text has been prepared by the exercise facilitator. Participants are then each given the opportunity, independently and anonymously in parallel, to extend that narrative by adding a following paragraph, describing what happened next. They are then allowed to view each of those alternative extensions, and then choose only one of those which they would most like to develop by adding another following paragraph, again independently and anonymously in parallel. In most exercises one immediate result will be that some initial versions of the story will be ignored, while others might be extended by more than one participant. As this process is reiterated what emerges is a branching tree structure of alternative storylines like that in Figure 1 below.

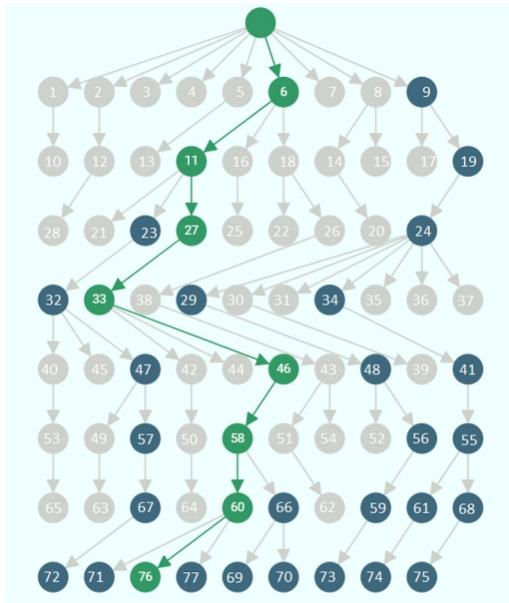

Fig. 1: Tree structure of alternative storylines generated by CSER Exercise 2.

In this CSER example there were up to 10 participants, who participated in eight iterations, visible as rows. The process begins at the top with a single seed paragraph and ends at the bottom, with nine surviving storylines. Each node represents a paragraph of text contributed by a participant, and the connecting lines show which new paragraph was added to which pre-existing paragraph. Grey nodes in the tree structure indicate paragraphs which were not continued and which in effect represent "extinct" storylines. Participants in subsequent iterations were not allowed to build on these. Dark green nodes represent paragraphs which others did build on and which became part of storylines which survived until the end of the exercise (bottom row). Bright green nodes represent one storyline which has been highlighted by a user of the ParEvo app. Doing so then brings up the full text of that storyline in a panel to the right of the tree structure, on the ParEvo user interface (seen in Figure 2 below).[7]

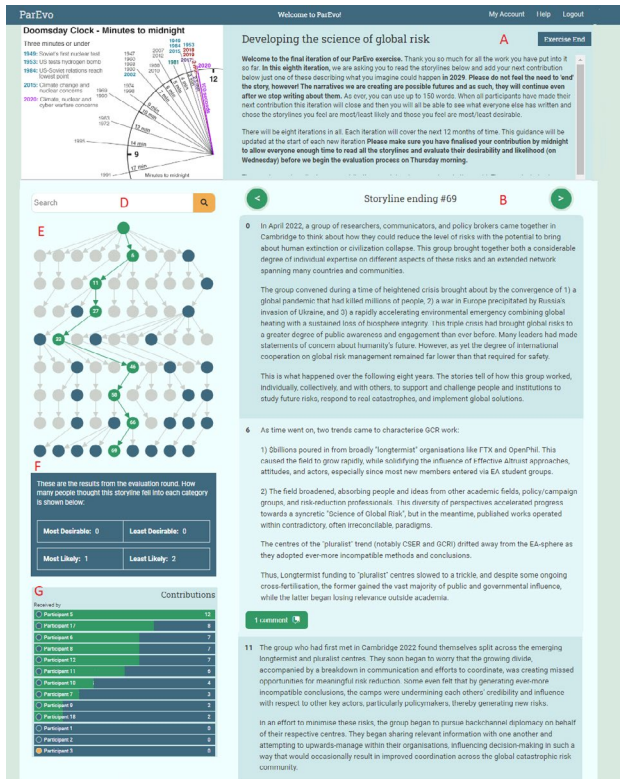

Fig. 2: The ParEvo user interface (contributors' text obscured).

Figure 2 shows six other features of the user interface. These include guidance provided by the facilitator, updated with each new iteration, seen on the top right; the full text of a selected storyline, presented on the right; comments on two of the participants' contributions; a search facility, above the tree structure; an evaluation widget below the tree structure; and a "leader board" on the bottom left. The use of the search facility, comment facility and leader board are optional. The leader board was not used in the CSER exercises.

3.2 Evaluation of storylines

When the process of generating a set of storylines is finished, participants are then asked to evaluate the storylines that they have helped to generate. This can be done using the widget built into the app, shown

in Figure 2, but can also be done using a more detailed online survey. The widget allows participants to make polar evaluation choices, i.e., which storyline they think is most or least likely, desirable, equitable, sustainable, etc. The available choices are set by the exercise facilitator. The online surveys used to date have used both open- and closed-ended questions about the contents and process (see example survey in Appendix 1). In addition, the facilitator can download from ParEvo.org 12 Excel formatted datasets containing automatically generated information about the contents of the storylines and the structure of people's participation in the exercise (listed in Appendix 2). Exercise facilitators have also organised post-exercise meetings of participants to solicit further views from the participants and to provide feedback on analyses by the facilitator.

3.3 Theory

There are three different types of theories about what happens during a ParEvo exercise. The first is the participants' own often tacit and informal theories about what might happen in the future, as evident in the contents of their contributions, and the resulting composite storylines.

The second is the exercise facilitator's expectations of what they want to see happen in the exercise they have designed and organised. As evident in the kind of futures they want to see explored, the kinds of people to be involved, the time span and granularity of the exercise, and the guidance they give to participants at the beginning of each new iteration. Exercise facilitators have a range of exercise design parameters they can vary in pursuit of these expectations (see Appendix 3).

The third is the expectations of the platform administrator (and designer of the ParEvo app). Each consecutive exercise has been, in effect, an opportunistic experiment, usually involving some new variations in the design parameters, primarily under the control of the exercise facilitator. Some of these variations are persisting across multiple exercises and others not. In addition to the evolutionary epistemology at the base of the design, there is an associated ongoing

interest in the role of diversity. This perspective has been informed by writings on diversity from a complexity perspective,[8] measures of diversity used in ecology and sociological uses of those ecological ideas,[9] and network analysis as a way of visualising and measuring diversity measures.[10] Measurement has been relevant when thinking about diversity as an independent variable affecting the creativity of the process, but also as a dependent variable that is descriptive of the range of possible futures that have been developed. Underlying the design of ParEvo, when used to look forward, is the assumption that the generation and analysis of a diversity of storylines will enable participants to be better prepared for the future, which is only likely to be partially knowable at best. In this context, the intention is not to predict the future, but to be able to be more adaptive and responsive to the futures that might take place.

This approach is consistent with a substantial body of evidence on the importance of diversity to the more general task of effective problem-solving, as referred to recently in Campbell et al.[11] However, in this instance the ambition has its origins in the author's work as an evaluation consultant, assessing the performance of international development aid programmes, and the theories of change embedded in those programmes. These are characteristically optimistic, focusing on expected and desired futures, but are challenged by unexpected events and diverse implementation contexts.[12]

A small number of other types of online platforms have been developed by futurists for collaborative exploration of alternative futures, and subject to review.[13] ParEvo differs from these in three respects. Firstly, there is a generative theory informing the process design — the social embodiment of the evolutionary algorithm. Secondly the process is more divergent and satisficing rather than convergent and optimising, as is the case with online Delphi exercises — a widely used method. Thirdly, with ParEvo the construction of narratives precedes and informs a detailed analysis, rather than following and being informed by a technical analysis of other available data. In this respect, it is more ethnographic in orientation, taking participants' views as the primary resource material. Notwithstanding these differences, Raford's review of these platforms has provided a

useful set of performance criteria relevant to the ongoing assessment of ParEvo and its further development (Appendix 4), some of which are discussed below.

Challenges

There are three broad challenges facing ParEvo facilitators and the administrator, including: (a) choosing the right design settings, (b) analysing the completed exercise, both the storyline contents and participation data, and (c) evaluating outcomes and impacts. The latter has been identified as an area of weakness in the field of futures research and practice[14] and will be explored here.[15] Evaluation can be done at three levels of aggregation, corresponding to the different types of theories of change introduced above: those of individual participants, individual exercises and the platform as a whole.

4.1 Participants

Until now participants have engaged in ParEvo exercises without receiving any intentional and explicit feedback on the nature of their individual performances. Nevertheless, evaluation surveys of participants in the last two CSER exercises indicate that many participants have enjoyed taking part.[16] Dropout rates during both exercises were small, with 93% of all 88 expected contributions being made in Exercise 1, and 96% of all 80 expected contributions being made in Exercise 2.

At best, participants can see what happens to their own contributions in subsequent iterations, i.e., whether one or more of the other participants choose to build on those contributions, and the way they do so — taking the storyline in the same direction or changing it radically. This behaviour seems to have different significance to different participants. The post-exercise surveys found varying opinions between the two exercises and within each exercise, with most but not all participants in the second exercise giving more importance to building on other participants' contributions, and vice versa.

Expectations and motivations might be expected to be different if there was more explicit feedback on participants' contribution

behaviour. Facilitators now have the option of making a "leader board" visible on the user interface, which shows for each participant how many other participants have built on their contributions and those of others. This could have the effect of more directly motivating participants to seek these types of responses. Its consequences have not yet been tested, but one possibility is that it may lead to more convergent content. That may be desirable in some situations, as discussed in the next section on exercise level performance. Another leader board is under development where the performance measure is the proportion of all the contributions to the surviving storylines that were made by each participant. This will provide a more summative view of each person's contributions towards a more collective end. But again, its consequences have yet to be tested. Both possibilities can be seen as a form of gamification,[17] an approach already recognised as relevant to enabling collective intelligence.[18]

Other forms of more individualised and nuanced feedback are already available using the comment and tagging facilities, used after contributions have been made in each iteration. In exercises to date, including the recent CSER exercises, the comment facility has been only used in a very non-directive way by the facilitators, raising questions rather than proposing directions or signalling approval or disapproval. The option also exists for participants to (anonymously) comment on each other's contributions, and for this to affect the overall structure and direction of the storylines. Analysis of any evaluative content of this kind, and its influence, will be more challenging.

4.2 Exercises

The expected post-exercise impacts of a ParEvo exercise vary from exercise to exercise, depending on the individual facilitator's objectives. To date, these have included:

- Influencing the content of a strategic plan (one exercise completed, one planned)
- Informing the publication of papers in an academic journal (two exercises)
- Informing the content of an evaluation (four exercises)

- Leading to the revision of risk management protocol (one exercise in process)
- Changing plans for ensuring research uptake (one exercise in process)

There are constraints on the extent to which the specifics of these impacts, and the associated causal mechanisms, can be identified by the platform administrator. Facilitators are not obliged to share post-exercise survey data, or other information about the subsequent effects of their exercise.

However, it is possible to identify more immediate differences in exercise outcomes, as distinct from post-exercise impacts, using measures that can be applied to almost all exercises, regardless of their specific objectives. As mentioned in the section on theory above, the generation of a diversity of alternative futures has been a default expected outcome for almost all ParEvo exercises to date. Drawing from the field of ecology, Stirling differentiated three facets of diversity, each of which are measurable:

- variety, also known as richness, which is the number of different kinds, e.g. species;
- balance, also known as evenness, being the relative numbers of each kind; and
- disparity, the degree of difference between kinds, e.g. between people and chimpanzees versus people and bacteria.[19]

In the analysis of a number of ParEvo exercises, these aspects of diversity have been measured in three ways.

4.2.1 Tree structures

The first method looks at the network structure of the storylines, in terms of disparity. Some storylines are more similar than others, in that they have many contributions in common, only diverging in the last iteration. The content of others are less so because they diverged in the very first iteration. Comparing the structure of storylines in two CSER exercises (Figure 3 below), four of the original storylines

survived to the last iteration in Exercise 1, but only two did so in the second. This aspect of diversity can be measured more specifically by counting the links connecting the surviving storylines, a simple network analysis measure of distance. There were 53 in Exercise 1, versus only 30 in Exercise 2. The significance of disparity is discussed further below.

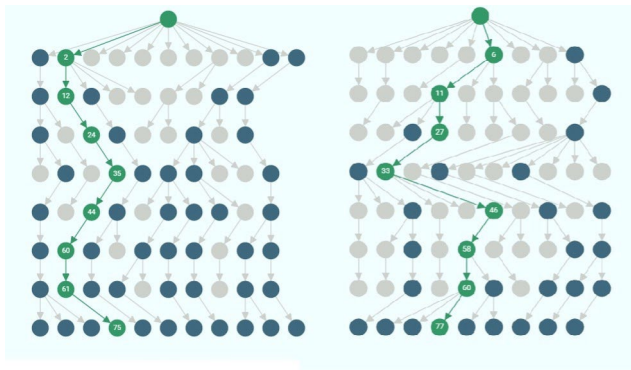

Fig. 3: Tree structures for CSER Exercises 1 and 2.

4.2.2 Combinations of sets of ideas

The second approach looks at the kinds of combinations of ideas that occurred, as a percentage of all possible combinations. Each participant can be seen as a set of ideas. When one participant's contribution builds on the contribution of another, this represents one of those kinds of combinations taking place. The total number of possible types of combinations can be seen in a participant *x* participant matrix, but is limited further if there are not enough iterations for all to occur, and if any participants drop out of any iterations. The percentage of those possible combinations actually occurring in Exercise 1 was 61%, whereas in Exercise 2 it was 70%. This measure, known as network density, is a crude measure of "variety".[20] This measure is of interest because the recombination of ideas is considered an important source of creativity both in biological evolution and human culture.[21]

4.2.3 Storyline evaluations

A third approach looked at diversity in the evaluation judgements of participants. At the end of both CSER exercises, after eight iterations had been completed, participants were asked to identify which specific surviving storylines they saw as describing the "most likely", "least likely", "most desirable", and "least desirable" futures — as seen from their own perspective. Their responses were then used to create a scatter plot within which there were four different quadrants of possibilities, as shown in Figure 4 below.

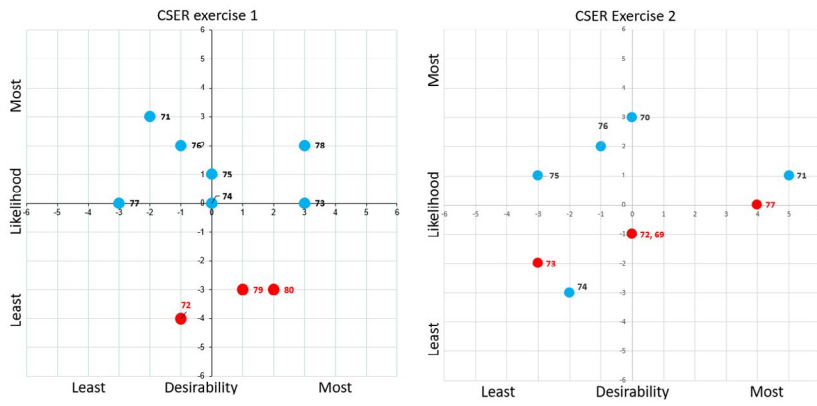

Fig. 4: Distribution of evaluations of the surviving storylines in CSER Exercises 1 and 2.

The values on each axis represent the number of participants who made judgements of that kind.[22] The assessment of storylines located towards the edges of the scatterplot had the support of more participants than those towards the centre. The red storylines were those where participants had conflicting judgements, where both polar extremes were applied to the same storyline, e.g. being most and least desirable. In Exercise 1 two of the three contradictory judgements were about desirability. In Exercise 2 three of the four contradictory judgements were about likelihood.

Diversity in this context can be measured in two different ways. Minimal diversity of judgement would be visible in the presence of only two storylines in the scatter plot, when all participants agreed that one storyline was most desirable and least likely, and the other was least desirable and

most likely.[23] Maximum diversity would be visible where all the surviving storylines appeared on the scatterplot. In both CSER exercises there was maximum diversity on this variety measure of diversity. Within all the possible combinations of judgments, the most disparate would be where participants expressed contradictory judgements about the desirability, or the likelihood, of a storyline. As noted above, these kinds of judgements were seen in both exercises, slightly more so with Exercise 2.

4.2.4 Implications for analysis

The diversity measurement options just discussed can be seen as mediating variables possibly affecting the post-exercise impacts exercise facilitators are aiming for, such as those listed above, or as dependent variables, of interest as more proximate outcomes. In both cases the exercise settings can be seen as the independent variables. The relationship between these types of variables remains to be explored. Findings could then inform how future facilitators can optimise the design of their exercises.

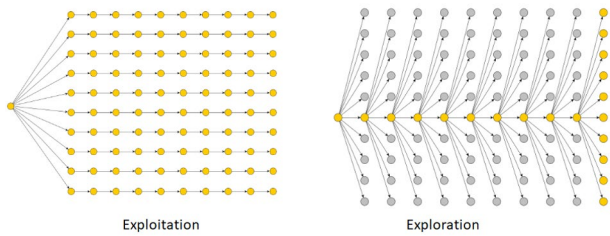

Fig. 5: Extreme examples of exploitation versus exploration search strategies in ParEvo exercises.

One dimension of optimisation is captured by the distinction made by organisational learning theorist James March, between "exploration", of the new, and "exploitation", of what is already known.[24] The question of which strategy is most appropriate in what conditions has been the subject of ongoing research since then.[25] The same distinction can be used to differentiate search processes used in different ParEvo exercises. The two extreme manifestations of these are shown in Figure 5. Exploration involves development of many disparate storylines, where exploitation involves the more detailed development of versions of a single preferred storyline.

Viewed from this perspective, and given the earlier analysis of disparity, Exercise 2 participants seemed to be pursuing a slightly more exploratory futures search than those in Exercise 1, although since participants were unaware of one another's choices, and thus could not know for sure whether they were building on the same contributions as their peers or not, this is hard to tell.

In the future, it is possible that some facilitators of ParEvo exercises may want to give more emphasis to exploitation, and for their participants to converge on a more specific view of the future. In the discussion above about the measurement of individual performance, two ways of measuring individuals' contributions were introduced, which if given as feedback via a leader board, could encourage such behaviour. That possibility needs to be tested.

4.5 Platform

At the platform level, objectives relate to sets of exercises. They have included:

- The development of new features in the ParEvo app. This was especially the case with six earliest exercises facilitated by the administrator, and has continued as a secondary objective thereafter. Visible improvements have included the development of a comment facility, a tagging facility, a leader board, and more flexible evaluation options.
- Further exercises by first-time facilitators. This has been the case with four facilitators, leading to six additional exercises to date.
- Requests by other organisations wanting to use ParEvo for the first time. Five new organisations were registered as users in 2022, with exercises planned in the next 12 months.[26]
- Accumulation of data from multiple exercises that is sufficient to enable analyses of exercise parameters and how they affect exercise outcomes. This process is underway. A supporting website, at https://mscinnovations.wordpress.com/, is accumulating information on the usefulness of different forms of analysis of this data.

- Publication of papers about ParEvo in academic journals and books. Six are in process to date.
- Recovery of investment costs, through payments for technical support provided to organisations using ParEvo. This has been underway since early 2022, although *pro bono* technical support for first-time users remains the norm, as does the free use of the app itself.

Objectives for the platform have changed over time. With the earliest exercises the main objective was to ensure that the web application functioned as expected. Then more attention was given to the development of evaluation options, within the app itself, and using third-party survey platforms. In the last 12 months, more emphasis has been given to ensuring sufficient post-exercise facilitated discussion amongst the participants, to work through the implications of the exercise, and its evaluation. This emphasis needs to be continued. More encouragement is also being given to exercise facilitators to articulate their objectives for their exercises before they start. Both facilitators did so in the two recent CSER exercises.

An Invitation

This chapter has provided a quick overview of ParEvo.org, a web-assisted process enabling the participatory exploration of alternative futures. It is hoped that researchers in Existential Risk Studies and elsewhere will see this as a potentially useful tool to explore how groups of people can collaboratively construct a diverse set of storylines around a topic of shared interest. Each exercise facilitator has considerable freedom in how they configure their own exercise. Lessons from previous exercises are available both from the ParEvo website and from the ParEvo administrator. Each exercise generates a significant body of qualitative and qualitative data, about both the storyline contents and participants' behaviour. A range of options already exist for the analysis of that data. Several important challenges relating to assessment of performance at different levels of aggregation have also been identified and could be addressed.

The following appendicies are available on-line 1) an example on-line survey, 2) a summary of downloadable datasets, 3) the adjustable parameters of a ParEvo exercise, and 4) a set of Platform Assessment Criteria.

https://doi.org/10.11647/OBP.0360#resources

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6 For a full listing see https://mscinnovations.wordpress.com/list-of-parevo-exercises/.

7 The participants' contributions have been blurred, because the publication of the text content of any ParEvo exercise is limited by the terms of the privacy policy, seen here https://parevo.org/privacy/.

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15 Other forthcoming papers by Beard, Mani and Hobson will explore the first two.

16 In both exercises, the average rating on an enjoyment scale (from 'Not at All' to 'A Lot') was above the midpoint.

17 Defined as the use of game features in non-game settings.

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20 Balance can also be calculated by examining the number of instances of each type of combination.

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22 Here, their scale position is a net value. The number of participants selecting a storyline as least likely (/least desirable) was subtracted from the number who selected the same storylines as likely (/desirable).

23 Or alternatively, most likely and most desirable, and least likely and least desirable.

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