A Modelling Strategy for Living with Deep Uncertainty:
Steps Towards Open, Contingent, Adaptive and Reactive Resilience

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After the Ebola outbreak of 2013-16, the UK "Minister for Preparedness" (Oliver Letwin), set up a small unit in the Civil Contingencies Secretariat (CCS) whose purpose was to scan for unanticipated threats to the UK, so that the government could react in a timely manner. For example, it allowed the government to consider whether to ban travel from countries affected by the Zika virus outbreak. Sometime during 2016-2019 this unit was disbanded [1]. It is easy to identify actions that, in hindsight, would have been better prepared the UK for the Covid-19 pandemic, however this illustrates a basic problem for governments (and other institutions) — that of how to mitigate the impact of the unexpected. In retrospect, Oliver Letwin said: "*The truth is, that we are just not very good at forecasting the character of the risks that we will encounter.*" [1]

Here we suggest an approach to achieving some level of resilience when in deeply uncertain situations. This approach is called "Open, Contingent, Adaptive and Reactive Resilience" (OCARR)[1]. It is designed to facilitate a rapid response in situations where many things could happen, including those that are difficult to envisage, but where there are too many possibilities to put in place contingency measures. It lies alongside other strategies suitable for other kinds of situation, for example those when one can predict the impact of a small range of policy choices [2], when there is a small set of anticipated possibilities but of unknown severity [4], or when stakeholders have very different views of possible outcomes [3].

The approach has essentially three stages: (1) Identify as many possible future events and their subsequent trajectories as one can, regardless of their perceived likelihood. (2) Analyse the trajectories of these possibilities that would pose a significant threat – understanding how they might come about and develop. (3) Implement "indicators" or "early warning systems" (e.g. visualisations) that give an indication of when these threatening trajectories might be emerging, so that the response can be as rapid as possible – allowing decision makers to more effectively "drive" policy by being able to react quickly. Of course, OCARR does not solve all the problems of deep uncertainty and needs using alongside other measures.

The paper illustrates steps (1) and (2) real of this approach, using an agent-based modelling of a complex fishing ecology interacting with humans to discover some of the trajectories that might emerge and understand their nature [6]. Given the deep uncertainties involved, this does not predict what will happen,

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[1] For more details on OCARR, please see [5].

or even what is probable to happen, but some of the otherwise unexpected outcomes that might happen – a possibilist rather than probibilist approach.

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