

Game theory and Artificial Intelligence in just preservation

Commentary on [Treves et al.](#) on *Just Preservation*

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Abstract: We humans can show presumption, arrogance and many dubious traits. By virtue of being land-dwelling, dexterous, relatively intelligent, and having good communication hardware and (good) fortune, we have for recent millennia largely had dominion of our planet. Yet humans often do not treat themselves (let alone other species) particularly well. Treves et al.'s idea of a multispecies justice system — not “prioritizing humans” but “finding practical ways to work within human systems” — invites consideration.

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1. Leaving everything to the markets — and the prisoner’s dilemma. Some schools of economics make the assumption that efficiency and optimal allocation of resources result when all agents act out of unbridled self-interest. We agree with Treves et al. (2019) about “[c]laims made about protecting the future by maximizing wealth today” and “short-term profiteering from nature veiled by claims about poverty alleviation or economic trickle-down”. The prisoners’ dilemma (Rapoport & Chammah, 1965) and the tragedy of the commons (Hardin, 1968) provide simple counter-examples to market efficiency. Emissions and climate change (Treves et al., 2019; Alexander, 2019; Attfield, 2019; Baker, 2019; Bergstrom, 2019; Gray, 2019; Palmer & Fischer, 2019; IPBES, 2019) show that binding agreements are needed in the justice system. Whether this need could be made more evident to the public by reporting changes in standard deviations rather than just in means and averages (of temperatures) — or even by inviting various commentators to enter prediction competitions — co-operation and agreements are surely necessary.

2. Intelligence and rights. Neuroscience presents evidence of cognition and emotional experience in animals including fish and bees (Correia Caeiro, 2020). Stories of intelligent non-

human animals abound (Greenfield et al., 2011; Pilley & Hinzmann, 2013; de Waal, 2016; Paxinos, 2015). Evidence of plant intelligence, too, is increasing (Attfield, 2019; Washington, 2019; Michmizos & Chilioti, 2019). Whether or not humans are the most cognitively complex species (Batavia, 2020), can we be sure they are the most *intelligent* Earth-based life-form (Dowe & Hernández-Orallo, 2011)?

3. Modelling optimal preservation efforts: A simple multi-objective criterion. Correia Caeiro (2020) emphasises the importance of protecting non-human species (even when human and non-human individuals are in conflict). For biological systems, just preservation efforts should not be purely anthropocentric (Chapman & Huffman, 2017). We need to acknowledge the importance of diversity across the spectrum, and the equal opportunity to co-exist, for any species. One way to allocate preservation efforts could be by modelling:

- i) An estimated value, $a > 0$, to humans for preserving a species (cf. Batavia, 2020).
- ii) An estimate of the extinction or contraction rate $b(t)$ of a species, varying with time, t (Elith & Leathwick, 2009). A contraction rate of $b(1)$ denotes that $1 - b(1)$ of that species remains in period 2.

Preservation efforts could then be modelled as the product of a and the $b(t)$ over the period of time (1 to T), or more formally:

$$\text{PreservationEffort} = a b(1) \dots b(T) \quad (\text{equation 1})$$

This agrees with Lambert (2019), who notes that the inadequate recognition of the needs of animal species is based on the high value accorded to protecting humans (focussing on a) relative to other species (focussing on b). Reducing just preservation efforts to the model in equation 1 would of course be an oversimplification, neglecting the problem of how to implement intra-species versus inter-species preservation as well as human entitlement in allocating preservation efforts for different species.

4. Artificial Intelligence (AI) and just preservation. Preserving species “for their own sake” becomes particularly important as we consider rapid developments in AI — for example, robo-species (like virtual bees) that mimic and replicate the functionality of natural endangered species. Such approaches overlook ethical aspects of preservation (Gleadow, Hanan & Dorin, 2019) and questions of impartiality. If used strategically, however, artificial (swarm) robots or robo-species could assist in reconstructing the desired environmental conditions for existing natural species to thrive again and evolve (Gleadow, Hanan & Dorin, 2019).

Robo-species, unlike many natural ones, could be purpose-designed for social good, suppressing the rivalry in consumption inherent in the prisoner’s dilemma. Intelligent robots (e.g., virtual bees as pollinators) could be used to transform and prepare currently uninhabitable environments in which their biological peers could then subsist and grow. AI might also have a positive role as the interacting factors (Palmer & Fischer, 2019; Spiegel, 2020) and justice system (Treves et al., 2019) become increasingly complex. Amongst the downsides or even dangers of AI

(Solomonoff, 1967; Dowe, 2014), its influence could be comparable to that of biological invasive species (IPBES, 2019; Washington, 2019).

Preservation and nature have themselves made positive contributions both to AI and to computing more generally. Nature-based computational search algorithms include ant colony optimisation, simulated annealing (Chmait & Challita, 2013) and genetic algorithms (Bossomaier & Green, 2000).

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