Modelling "the Expanding Circle" of Cooperation Towards a Sustainable Future

By Steven R. Smith[1]

Abstract

Can human cooperation expand to the global scale in time to avert catastrophic climate change? Prospects for a sustainable future depend on binding commitments that respect biophysical limits, which in turn depend on political support and global/intergenerational levels of moral concern. Numerous studies in the social sciences indicate that transcending parochial, group-level cooperation to the global scale requires some form of unifying "superordinate goal". This research explores what this transformative humanitarian goal might consist of, and what factors most influence the dynamics of human cooperation. Two quantitative models of cooperative social dynamics are developed and analysed: 1) Historical - analysing the global growth of social insurance provision and the abolition of slavery, including their key structural (macro) predictors; 2) Experimental - analysing the dynamics of cooperation and the consideration of future generations in a multiplayer social dilemma game. Longitudinal growth curve modelling (LGCM) of these models' data allows many variables to be simultaneously combined into a single group of path coefficients, represented as a network of relationships over time. Preliminary results in the historical model a) confirms the view that social complexity expands more rapidly than cooperation, b) The rate of acceleration of cooperation required to ensure sustainability within the available time greatly exceeds the historical trend.

Keywords: cooperation, dynamics, sustainability indicators, co-conn ratio, social movements, cultural evolution, future generations

1. Introduction

Half a century of research in experimental social psychology, behavioural economics, sociology and anthropology has shown that humans are not, for the most part or most of the time, utility-maximising individualists. We are innately cooperative creatures - at least in short-term, tribal contexts (Nowak, 2006; Tomasello, 2008; Cosmides, Barrett & Tooby, 2010; De Waal, 2009; Boehm, 2011). Although non-excludable resources are often over-exploited as in the Tragedy of the Commons (Hardin, 1968), this can also be avoided by collective agreement, either through informal or legal institutional frameworks (Ostrom, 1990). In theory, these cooperative frameworks have no size limit. Given the opportunity, human populations expand and become more complex, as has been recognised at least since Ibn Khaldun (1377). With complexity comes connectivity through trade, communications, transport, literature, education and urbanisation (Pinker, 2011; Shermer, 2015; Benkler, 2011). Greater connectivity expands social networks of trust, cooperation and common identity (Singer, 1981; Krznaric, 2014; Hunt 2007). There is, however, a great paradox: the vast amount of energy and technology necessary to build a global, cooperative civilisation is also creating enough waste pollution to destroy it (Rifkin, 2009; Ophuls, 2012, Welzel, 2013).

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Without additional efforts (beyond what is already agreed) to reduce greenhouse gas emissions, we are heading for global warming of between +2.5^{o}C and +7.8^{o}C by 2100 (IPCC, 2014). For these reasons, even though civilisation-endangering effects might not be felt until the end of the century, it is the actions of this generation, over the next several decades to 2050, that are critical. If we can eliminate net CO_2 emissions by 2050 and restrict the global average temperature rise to within +2°C, we have a 50/50 chance of avoiding potentially catastrophic consequences towards the end of the century (Rockström, Gaffney, Rogelj and Meinshausen, 2017; Randers, 2012; Kolbert, 2014).

As with any potential Tragedy of the Commons, the only solution is by collective agreement. The important question is: Can we learn to enhance and institutionalise cooperation at all scales fast enough? No empirical study has properly addressed this question. There are only speculative studies of either optimists (e.g. Lomborg, 2001; Ridley, 2011; Stoknes, 2015) or pessimists (e.g. Heilbroner, 1991; Lovelock, 2009; Ehrlich and Ehrlich, 2005; Kahneman and Slovic (cited in Marshall, 2014); Persson and Savulescu, 2012).

This research aims to address the important question of the scalability and generation of cooperative institutions. It proceeds by modelling the dynamics of cooperation towards sustainability. It introduces a social-psychological indicator of sustainability, the cooperation-connectivity (co-conn) ratio, in which sustainable societies exhibit a co-conn ratio of 1.0 (refer to Figure 1[1]). The co-conn ratio is the dependent variable used in two research themes being investigated at the Centre for Environment and Sustainability (CES). Theme 1 investigates socio-historical case studies including the global growth of social insurance provision and the abolition of slavery; Theme 2 analyses the dynamics of cooperation and the consideration of future generations in a multiplayer social dilemma game. The remainder of this paper focuses on Theme 1 - the socio-historical case studies.

2. Sustainability Indicators

The concept of sustainability offers a calculation of the Earth's biophysical capacity to support a given human population (and by extension, the ecosystems that it depends upon) at a given level of development, indefinitely (Olson, 1995; WCED, 1987). There are already a number of frameworks that directly measure sustainable bio-capacity, including the Environmental Performance Index (EPI: Yale Center for Environmental Law & Policy, 2016), the Sustainable Society Index (SSI. Sustainable Society Foundation, 2014), the Global Footprint (Global Footprint Network), the Planetary Boundaries Framework (Rockström et al., 2009), the Doughnut of Social and Planetary boundaries (Raworth 2012 and 2017), and the U.N. Sustainable Development Goals.

3. The Co-Conn Ratio

The co-conn ratio is a social-psychological indicator of sustainability based on cooperation expressed as a fraction of social complexity/connectivity. We propose that

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[1] trajectories and other co-conn ratios are for illustrative purposes only.

all sustainable societies will exhibit a global (i.e. everyone in the society) level of cooperation, in that the average individual cooperates to ensure at least the basic survival of everyone else in the society. Thus, in a sustainable society the average sphere of minimal cooperation equals the population, or co-conn ratio = 1.0 (see Figure 1).
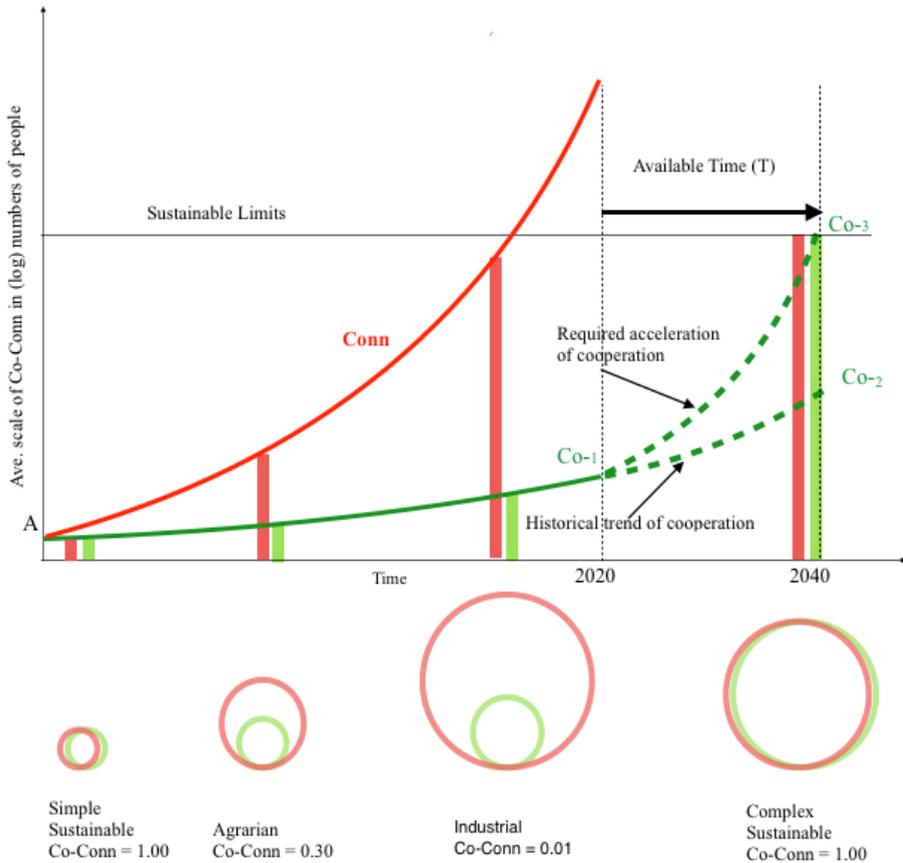
Figure 1. The Evolution of Co-operation (Co-) and Connectivity (Conn). Curvilinear progressions are for explanatory ease. Progressive change is not assumed.

$$\frac{co-}{conn} = \frac{co\text{-operation}}{connectivity} = \frac{number\ of\ people\ protected}{total\ number\ of\ people}$$

3.1 Cooperation

Cooperative behaviour can be defined as "engaging with others in a mutually beneficial activity" (Bowles and Gintis, 2011, p. 2). A cooperator may be motivated by an altruistic concern for others, by a categorical/Kantian principle of duty, or by self-interest (Batson, 2011). Cooperation also applies to social contracts for solving social dilemmas or collective action problems (CAPs), where all parties forego some immediate personal benefit for the sake of a longer-term collective benefit (Olson, 1995). The social-historical study presented in this paper uses the introduction of socially

progressive legislation in target countries as proxies for measuring the evolution of cooperation. The preliminary analysis simply assumes that the "number of people protected" is the national population at each time plot from the year of enactment onwards.

3.2 Connectivity

Connectivity relates to a society's overall size and social complexity, or the number of individuals that make a social, economic or political contribution, and their interactions (Christakis and Fowler, 2011). Korotayev and Khaltourina (2006) suggest that the population of the largest city/settlement within a country is a reliable indicator of its complexity, as demonstrated in cross-cultural anthropological studies of pre-agrarian, agrarian and early-industrial societies. The research project proposes this metric for the social-historical study as the measurement of connectivity in the co-conn ratio. However, the preliminary analysis presented here simply counts the number of countries, among the twenty-five most populous, that have adopted the social protection over time.

3.3 The Co-Conn Ratio as a Sustainability Indicator

One advantage of the co-conn ratio over other sustainability measures is that, given comparable proxies for cooperative behaviour, comparisons can be made with any society for any time-period for which meaningful data can be obtained. A further attraction is its simplicity: the use of numbers of people as the common unit of measurement of cooperation and population size/connectivity overcomes a significant problem of data integration that exists in other sustainability measures. The EPI, for example, is calculated from a weighted aggregate of twenty units of measurement across nine issue categories; the SSI is a weighted aggregate of twenty-two different units of measurement grouped into five categories; the Planetary Boundaries framework identifies nine threshold measurements for sustainability, and Raworth's (2012, 21017) Doughnut framework extends these nine planetary "ceilings" with a further eleven social "foundation" measurements.

A global level of cooperation may be regarded as a necessary but insufficient feature of a sustainable society. It is necessary for two reasons: firstly, a sustainable society must by definition be globally cooperative to the extent that it must maintain collective self-control; secondly, any human population is unlikely to be motivated to ensure the survival of future generations without first being concerned about those already alive. However, the co-conn = 1.0 benchmark is insufficient because sustainable societies must (by definition) be more than merely globally cooperative. They act to ensure the basic survival of more than the existing population. They must also consider future generations. This added intergenerational element is necessary because the overall impact (understood as a function of population, affluence and technology according to Holdren, and Ehrlich's I=PAT equation) of a sustainable society must be kept within biophysical limits to avoid an ecological "overshoot" (Randers, 2014) that would eventually threaten the society's collapse. This has traditionally been achieved in sustainable societies through various methods of resource conservation (Ostrom, 1990), birth control and infanticide (Diamond, 2005). A genuinely sustainable society, therefore, demands the maintenance of an *intergenerational* cooperative framework, not just the global cooperative

framework of a co-conn = 1.0 society. Despite this insufficiency, this research argues that modelling co-conn ratios over time nonetheless provides a valid benchmark for measuring the time that it takes populations to progress to the global level of cooperation on the way to the intergenerational level required for genuine sustainability.

4. A Social-Historical Model of Cooperative Dynamics

This social-historical study uses time-series national data on population and social statistics to measure the rate of global expansion of socially progressive movements as proxies of cooperation, from 1800 to the present. This encompasses the greatest period of technology-based expansion and extensions of 'empathic' concern in human history and coincides with the beginning of reliable social statistics collection (Rifkin, 2009; Pinker, 2011; Krznaric, 2014).
Cooperation has been acknowledged as an important factor in the history of human progress and social movements (Hunt, 2007; Rifkin, 2009; Pinker, 2011; Krznaric, 2014; Shermer, 2015). Progressive social movements such as the abolition of slavery, judicial torture and capital punishment, the protection of children and the elderly, the rights of women, social insurance, universal health care, universal suffrage, racial equality, LBTG rights and animal rights, have a unique historical trajectory that can be measured with the co-conn framework.

4.1 Cooperation Exemplified by the Provision of Social Insurance
As defined above, a necessary (but insufficient) feature of a sustainable society is a commitment to cooperate for the basic survival of the whole population as expressed in the ratio of co-conn = 1.0. The provision of basic protection in the form of statutory social insurance benefit is similarly a commitment to ensure the basic survival of a whole population, and is (at least partly) an ethical decision made by governments on behalf of their people, and its global adoption can be measured over time. Although it is recognised that national social insurance schemes each have their own, complex formulas for qualifying contributions and payouts, and many have evolved piecemeal, for the purposes of this preliminary study the complexity is reduced by recording the year in which the first national scheme came into force in the target countries.

4.2 Cooperation and The Abolition of Slavery
The abolition of slavery provides further evidence of the length of time it takes for the global population to cooperate for social progress (Yerxa, 2012). It is also relevant to the issue of climate disruption in terms of the economic costs involved. Hayes (2014) points out that "the climate justice movement is demanding that an existing set of political and economic interests be forced to say goodbye to trillions of dollars of wealth. It is impossible to point to any precedent other then abolition" (Hayes, 2014, p. 4). In 1860, slaves represented about 16% of the total household assets in the US, roughly the value of carbon reserves that must be left in the ground to stay under 2C warming (Hayes, 2014). This study records the year in which slavery was abolished in

each of the target countries[2].

4.3 Cooperation and the Abolition of Capital Punishment

As of the end of 2015, 102 out of 193 countries[3] have legally abolished capital punishment[4]. 89% of all 1,634 officially acknowledged executions[5] in 2015 took place in just 3 countries: Iran (977), Pakistan (326) and Saudi Arabia (158). The figure for China (believed to be in the thousands) is a state secret (Amnesty International, 2016)

4.4 Cooperation and Women's Suffrage

After the French Revolution of 1789, many revolutionaries addressed the plight of persecuted minorities but opposed rights for women (Hunt, 2007). Similarly, Jefferson promoted the political participation of white men, but not women. A women's movement was formed with public support from writers such as Condorcet (1790), Olympe de Gouges (1791) and Mary Wollstonecraft (1792) and political clubs were established in Paris and 50 provincial French cities. And yet, the 19th Century witnessed no profound breakthrough. Women did not receive equal political rights in any country of the world until the 20th Century.

5. Preliminary Analysis

Figure 2 illustrates the preliminary analysis of case studies on the abolition of slavery, the abolition of capital punishment, the provision of social insurance and women's suffrage.
Data has been taken from of 25 most populous countries (Clio-Infra, 2012), which represents all countries with populations in excess of 50 million people, or 75% of the total world population and 73% of global nominal GDP (World Bank WDI, 2011). The Y axis represents the number of countries in which the various social protections have been enacted in national law, from 0 - 25. The plots show remarkably similar gradients for the abolition of slavery, the abolition of capital punishment, and the provision of statutory unemployment benefit. The abolition of slavery has a timescale of approximately 150 years. Women's suffrage appears to have progressed more rapidly, over a timescale of less than a century although, as previously mentioned, the movement had been "simmering" in Europe without any major breakthroughs since the end of the 18th Century. The important role of women in the wartime economy during WW1 is often credited with increasing sympathy with the cause of women's suffrage in the UK and elsewhere (Foot, 2005).

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[2] Although slavery is illegal "de jure" in all countries, the Global Slavery Index estimates that 45 million people are enslaved today http://www.globalslaveryindex.org
[3] representing about 50% of the world population
[4] increasing to about 66% if you include those that have abolished it in practice
[5] excludes China
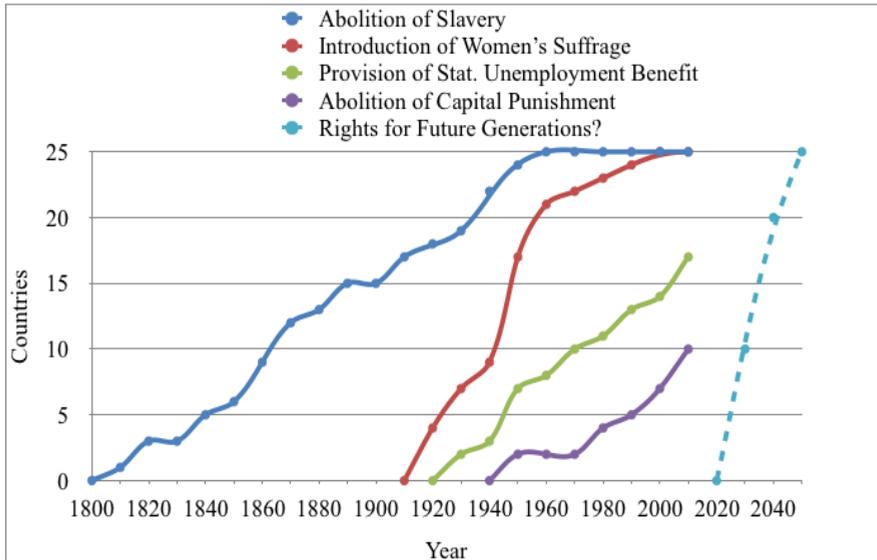
Figure 2: The Historical Growth of Key Social Movements: 1800 - 2000

The abolition of slavery[6], the abolition of capital punishment[7], the provision of statutory unemployment benefit[8] and female suffrage[9] are used as proxies to measure the global expansion of cooperation for social progress.

6. Discussion: Measuring progress towards sustainability thinking

All progressive social movements, from universal suffrage to racial equality to universal health care, have in their essence the recognition of the fundamental intrinsic value of human life (Stoknes, 2015). The movement for sustainable development extends the value of human life beyond the current population, insisting that the lives of future humans also deserve consideration. This goes beyond cooperation. It requires altruism, because it ask us to value the welfare of future people who do not yet exist and therefore cannot reciprocate. Humanity and human civilisation have to be valued for their own sakes. Eco-centric versions of 'sustainability' extend the circle of ethical concern for intrinsic value still further to encompass other species and habitats.

The scientific consensus is that we have a timescale of one generation to reach agreement on a plan to limit global warming to within a +2.0 °C "safe operating space for humanity" (Rockström et al., 2009; IPCC, 2014; Jackson and Webster, 2016). Therefore, in Figure 2, the expansion of legal protection for future generations must

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[6] Wikipedia Abolition of Slavery Timeline. https://en.wikipedia.org/wiki/Abolition_of_slavery_timeline #cite_note-Historicalsurvey-24

[7] Wikipedia Capital Punishment by Country. https://en.wikipedia.org/wiki/Capital_punishment_by_country #Asia

[8] U.S Social Security Administration. https://www.ssa.gov/policy/docs/progdesc/

[9] Wikipedia Timeline of Women's Suffrage. https://en.wikipedia.org/wiki/Timeline_of_women%27s_suffrage

reach the global scale by 2040, by incremental national and cross-societal initiatives as in historical social movements, and by global breakthroughs via the United Nations. This is clearly a much steeper gradient than is found in the other case studies. It is arguably also a far more difficult proposition. We may have the advantage of instant global communications, global institutions, a more educated public and the technologies to effect transformational change. But there are billions more people whose values must expand to meet the scale of the challenge. There are also more powerful forces whose self-interests are threatened by sustainable policies and who are strongly motivated to derail them. Many developing countries are also suspicious of "ecocentrism" and its potential to limit their aspirations for economic prosperity (Westra, 2006). Moreover, people have little natural ability to sympathise strongly about distant, nebulous or abstract concerns, like a sustainable civilisation (Kahneman, 2011; Fehr, 2015). As Mahatma Gandhi and Martin Luther King, Jr. understood well, mass sympathy for a principle of justice requires the sight of real people suffering injustice: the abolitionists had the horrifying, first-hand accounts of freed slaves; the American civil rights movement had Rosa Parks and the students of Little Rock; more recently, the Mediterranean refugee crisis had the tragic image of a drowned boy, Aylan Kurdi. Other than possibly through fiction or deep contemplative practice, it is extremely difficult to feel compassion for future people.

As illustrated in Figure 2, the "Rights for Future Generations" legislation metric for measuring cooperation towards a sustainable future is set at 0. Nations have been expressing their concerns for future generations since the creation of the United Nations, "Safeguarding for future generations" was first legally recognised in the context of whale preservation in 1946 (Gillespie, 1997). The concept was largely neglected for the next quarter century, until Principle 1 of the 1972 Stockholm Declaration of the United Nations Conference of the Human Environment, which declared a "solemn responsibility to protect and improve the environment for present and future generations". It has since been invoked dozens of times in aspirational "soft law" terms, such as in the preambular sections of international conventions and treaties (Westra, 2006), and has became common rhetoric in the political discourses of world leaders since the late 1980s (Gillespie, 1997). However, there are currently no "substantive provisions" as conceived by intergenerational rights campaigners such as Edith Brown-Weiss (1992), either in national or international law. Neither are future generations yet represented by an international commissioner or ambassador (Lawrence, 2014). Serious practical, motivational and theoretical obstacles to progress in this regard include the more immediate and pressing needs of present generations and the legal standing of potential future persons (Gillespie, 1997).

The situation is, however, changing. A few legal judgements have been successful that specifically appealed to the rights of future generations and used the principle of "parens patria" (the responsibility of the state to protect persons unable to defend their own rights). One was the case of Minors Oposa, brought by children seeking to protect the rainforest in the Philippines in 1993, and another involved the state of Massachusetts' right to protect its citizens by regulating emissions from automobiles, in 2007 (Westra, 2006). More recently, in 2015, a group of 21 children (including the granddaughter of climate scientist James Hansen, who also stands as plaintiff on behalf of future

generations) filed a lawsuit against the US government asserting that their failure to address climate change is in violation of their rights to life, liberty and justice. Their case was granted legal standing in November 2016 and is currently in preparation for trial[10]. Also in 2015, the devolved National Assembly of Wales passed the Well-Being of Future Generations Act, which established an office of Future Generations Commissioner[11].

These are welcome initiatives. Yet, a single generation (20-25 years) to 2040 is a brief period. Can we reach the global/intergenerational level of cooperation in time to secure a sustainable future? Some observers believe that we can, and that the required rapid expansion in human values is already being felt. In his book *Journey to Earthland: The Great Transition to Planetary Civilisation (2016),* Paul Raskin declares that humanity is "on the cusp" of a revolutionary transformation to an era of global "empathic embrace". He sees the stirrings of a "vast and plural global citizens movement" that will end the premise of indefinite growth and replace it with a premise of ecological limits and social standards. This prediction is echoed in Jeremy Rifkin's (2009) observations of an emerging "biosphere consciousness and global empathy" and in Naomi Klein's (2014) description of a global "movement [that] has yet to find its full moral voice on the world stage, but it is most certainly clearing its throat." Paul Hawken (2007) calls it simply "the Un-named Movement".

The "movement" may indeed be expanding, but there must have been many women in late 18th Century France and Britain who felt that their movement was equally on the brink of a revolutionary surge. What this social-historical study shows is that empirical evidence of the progress of social movements is useful in seeking to understand the pace of cultural evolution. The forces that motivate entire populations to adopt more expansive ethical concerns tend to evolve slowly, over timespans of many decades if not centuries (Elias, 1939; Malik, 2014; Hunt, 2007; Pinker, 2011). Human civilisation is now globally connected, but this does not mean that global moral maturity must automatically and imminently follow. There are different kinds of cooperation: the kind that drives technology and trade expands at a faster rate than the cooperation that drives social rules and norms (see Figure 1). The former only requires mutual self-interest and a minimal amount of trust. The latter tends to restrain self-interest and is a much more tedious, complex affair. Whenever a society attempts to control the self-interest of powerful individuals or groups, those groups often have the resources to challenge it, either overtly by force or covertly by buying media and political influence and reshaping public perceptions in their favour - all of which leads to a long and bitter struggle. As Stanford University futurist Paul Saffo put it, "collective minds change at a snail's pace, whereas technology races along an exponential curve" (Saffo, 2014, p. 52); or, "science gathers knowledge faster than society gathers wisdom" (attributed to Isaac Asimov). Correlational analyses of the key structural/macro factors that influence this rate - for example GDP per capita growth, inequality, literacy and education, health and well-being, trade/globalisation, urbanisation, and trusted institutions - may also be helpful in understanding the conditions that most favour the expansion of cooperation.

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[10] Visit ourchildrenstrust.org for more details.

[11] Similar mechanisms around the world that recognise future generations are detailed on the World Future Council's "Future Justice" site http://www.futurejustice.org/resources/global-view-of-mechanisms-recognising-future-generations/

Raskin's book, *The Earth Charter* (2000), the Papal Encyclical *Laudato Si'* (Pope Francis, 2015) and many similar works appeal to people to expand their collective moral worldviews, as though this was a matter of conscious personal will. However, in order for people to think and act for the global good, they need both the capacity and the opportunity to do so (Tantram, 2014): firstly, people need the mental capacity to grasp the scale of the issues and to care enough about solutions; secondly, people need the opportunity to act at personal, local, national and global levels within a system of global governance in which they have a meaningful voice. The values that people are capable of adopting are a reflection of the social, economic and political norms and contexts they find themselves in. Likewise, the opportunities available to act on those values depend crucially upon the social and historical context. If it were merely a matter of an appeal to values, then the universal moral appeals of the ancient Stoics, Buddhists and Mohists would have solved the problem of collective action a long time ago.

If optimism is the reasoned expectation that things will turn out well, our research provides little evidence to support optimistic predictions of a sustainable future. Socially progressive movements have historically taken much longer than a generation to expand globally. Instead, perhaps hopeful realism might be a more powerful perspective to adopt; hopeful in the poet Vaclav Havel's definition - the idea that something makes sense regardless of how things turn out.

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