

Social tipping dynamics for stabilizing Earth's climate by 2050

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Social tipping dynamics for stabilizing Earth's climate by 2050

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Significance

Achieving a rapid global decarbonization to stabilize the climate critically depends on activating contagious and fast-spreading processes of social and technological change within the next few years. Drawing on expert elicitation, an expert workshop, and a review of literature, which provides a comprehensive analysis on this topic, we propose concrete interventions to induce positive social tipping dynamics and a rapid global transformation to carbon-neutral societies. These social tipping interventions comprise removing fossil-fuel subsidies and incentivizing decentralized energy generation, building carbon-neutral cities, divesting from assets linked to fossil fuels, revealing the moral implications of fossil fuels, strengthening climate education and engagement, and disclosing greenhouse gas emissions information.

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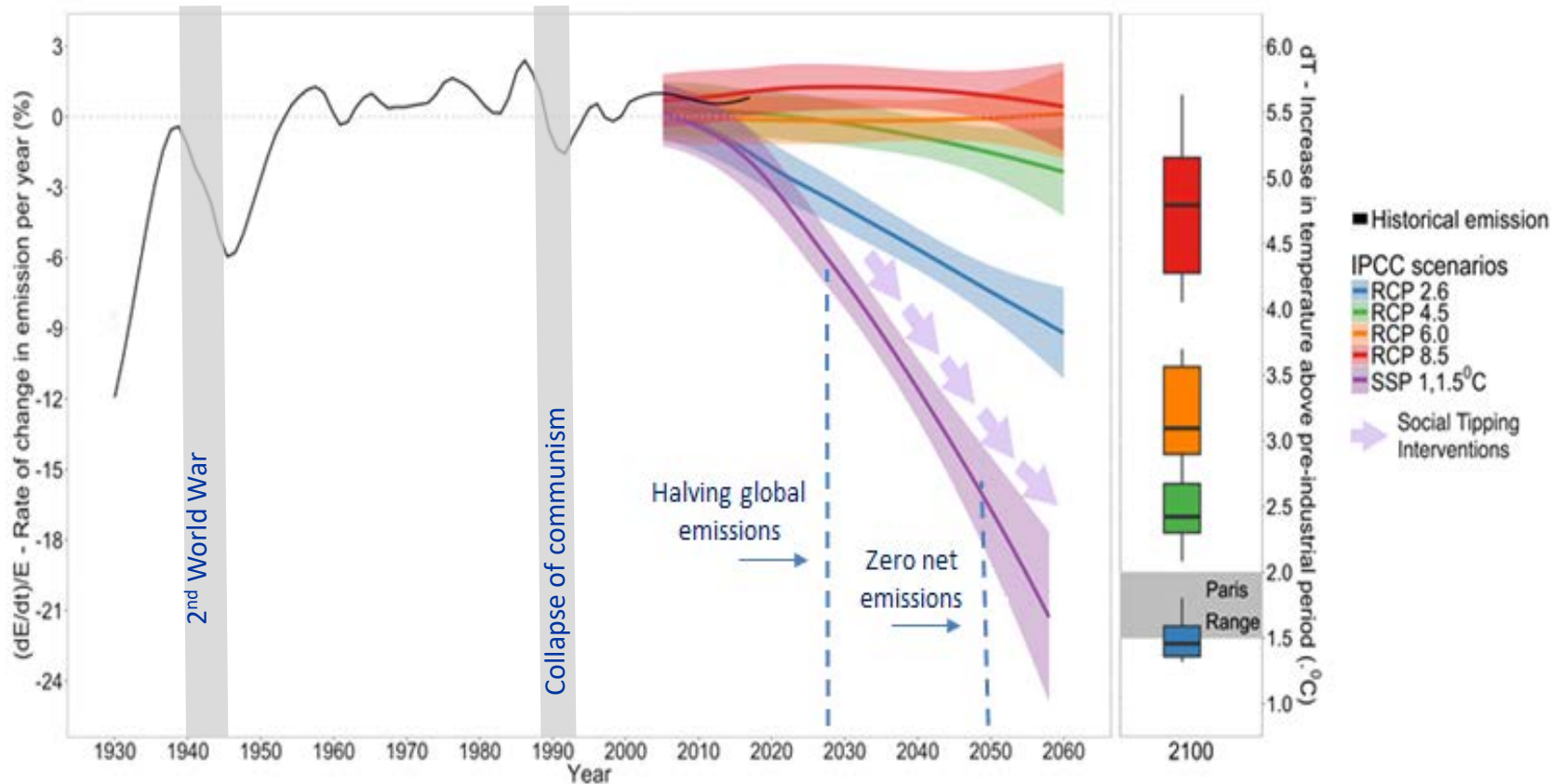
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The rate of emissions reduction that is needed to reach the Paris climate targets

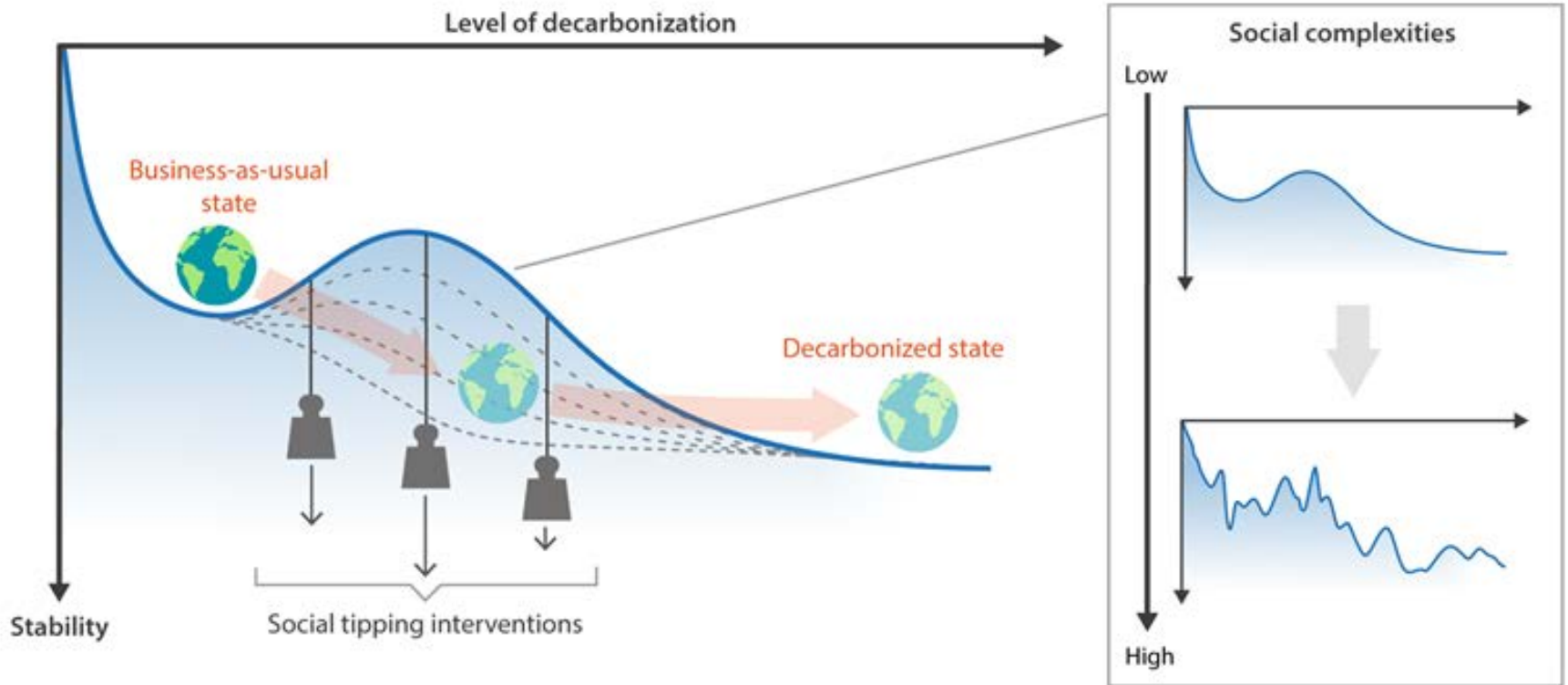


How to tip the world to a decarbonized state?

- Incremental / gradual change and rapid change
- Social tipping has deep roots, going back to Schelling, Granovetter et al., recent literature review: Milkoreit et al., Environmental Research Letters (2018)
- Evidence for social tipping effects in data and models of public opinion, social norms, investment choices on financial markets etc. (e.g. Nyborg et al., Science, 2016)
- Recent experimental evidence for Pareto principle in social tipping: ~25 % minority of actors can change the majority's attitudes etc. (Centola et al., Science, 2018)



Social tipping dynamics

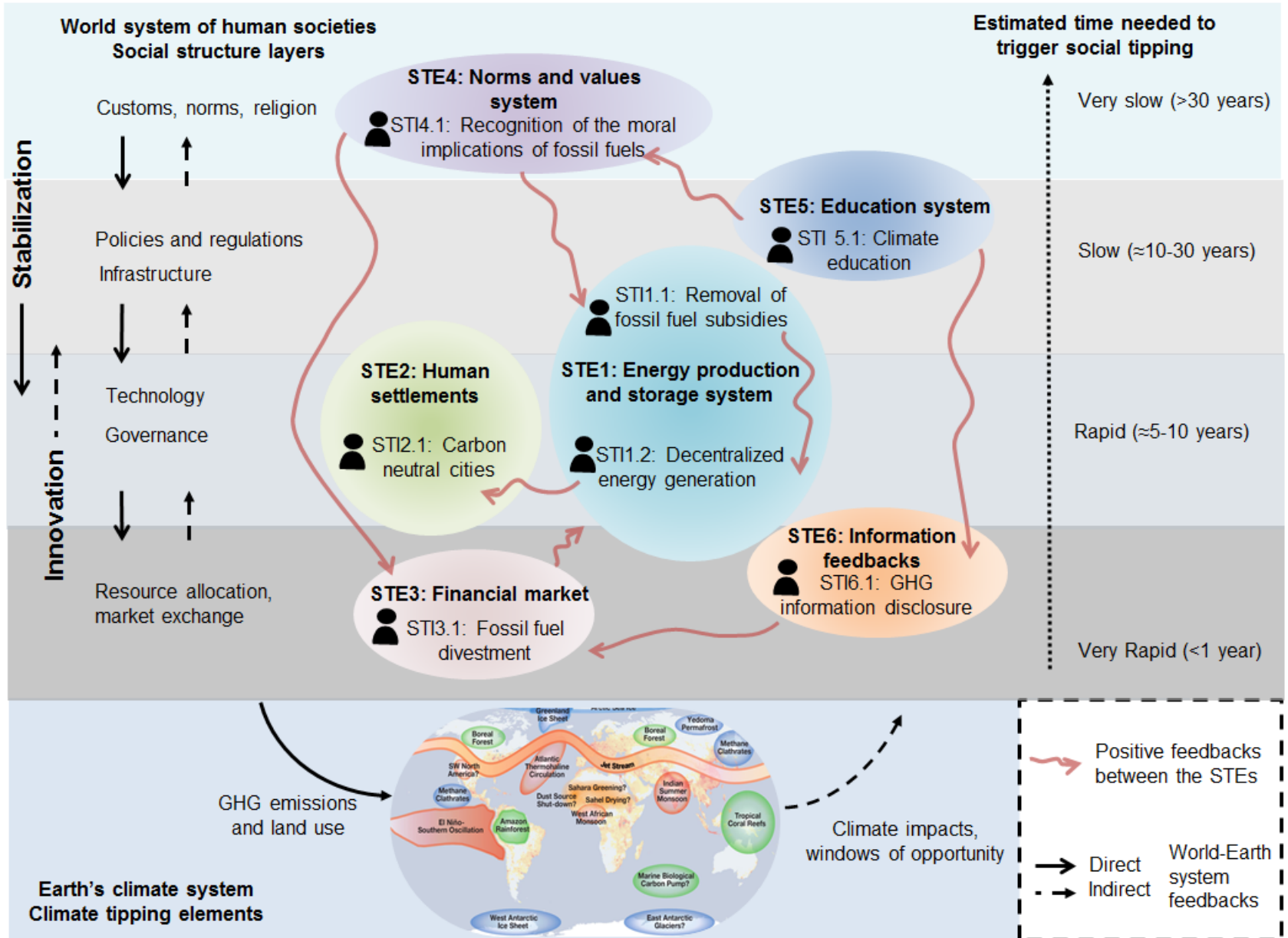


- Small interventions with big system effects
- Compatible with SDGs

Expert elicitation results

Social tipping element	Tipping intervention	Control parameter	Potential to reduce GHG emissions	Dominant social structure level	Estimated time need to trigger tipping
STE1: Energy production and storage	TI1.1: Subsidy programs	The price of fossil-fuel-free energy	Up to 21% globally in one year (Coady et al. 2015)	National policy (Coady et al. 2015)	10-30 years (Williamson 2000)
	TI1.2: Decentralized energy generation		Up to 100% in power supply (Dalton, Lockington, and Baldock 2009)	Community / town governance (Yadoo and Cruickshank 2012)	Less than 10 years (Aylett 2013)
STE2: Human settlements	TI2.2: Carbon neutral cities	The demand for fossil-fuel free technology	Reduction by 32% in 14 years (Energy Cities 2010)	Urban governance (Energy Cities 2010).	Approx. 10 years (Energy Cities 2010).
STE3: Financial market	TI3.1: Divestment movement	Profitability of fossil fuel exploitation	26% emissions tied to investments of a Canadian large university (Ritchie and Dowlatabadi 2013)	Market exchange, enterprise Carrington 2016)	Very rapid, could occur within hours (Kotz 2009)
STE4: Norms and values system	TI4.1: Recognizing the immoral character of fossil-fuels	The perception of fossil-fuels as immoral	Unprecedented	Informal institutions, enforcement through peer-groups (Padilla and Perez 2003)	30-40 years (Nadelmann 1990)
STE5: Education system	TI5.1: Climate education	Climate change and impacts awareness	Up to 30% reduction in two years in the emissions of the included in the study Italian households (RACES 2011)	National policy (Story, Nanney, and Schwartz 2009)	10-20 years (Story, Nanney, and Schwartz 2009)
STE6: Information feedback	TI6.1: Emission information disclosure	The number of products and services disclosing their carbon emissions	Up to 10% reduction of emissions in UK households grocery consumption in a year (Upham, Dendler, and Bleda 2011)	Market, exchange (Fraser 2017); enterprise (Banerjee and Solomon 2003)	A few years (Siró et al. 2008)

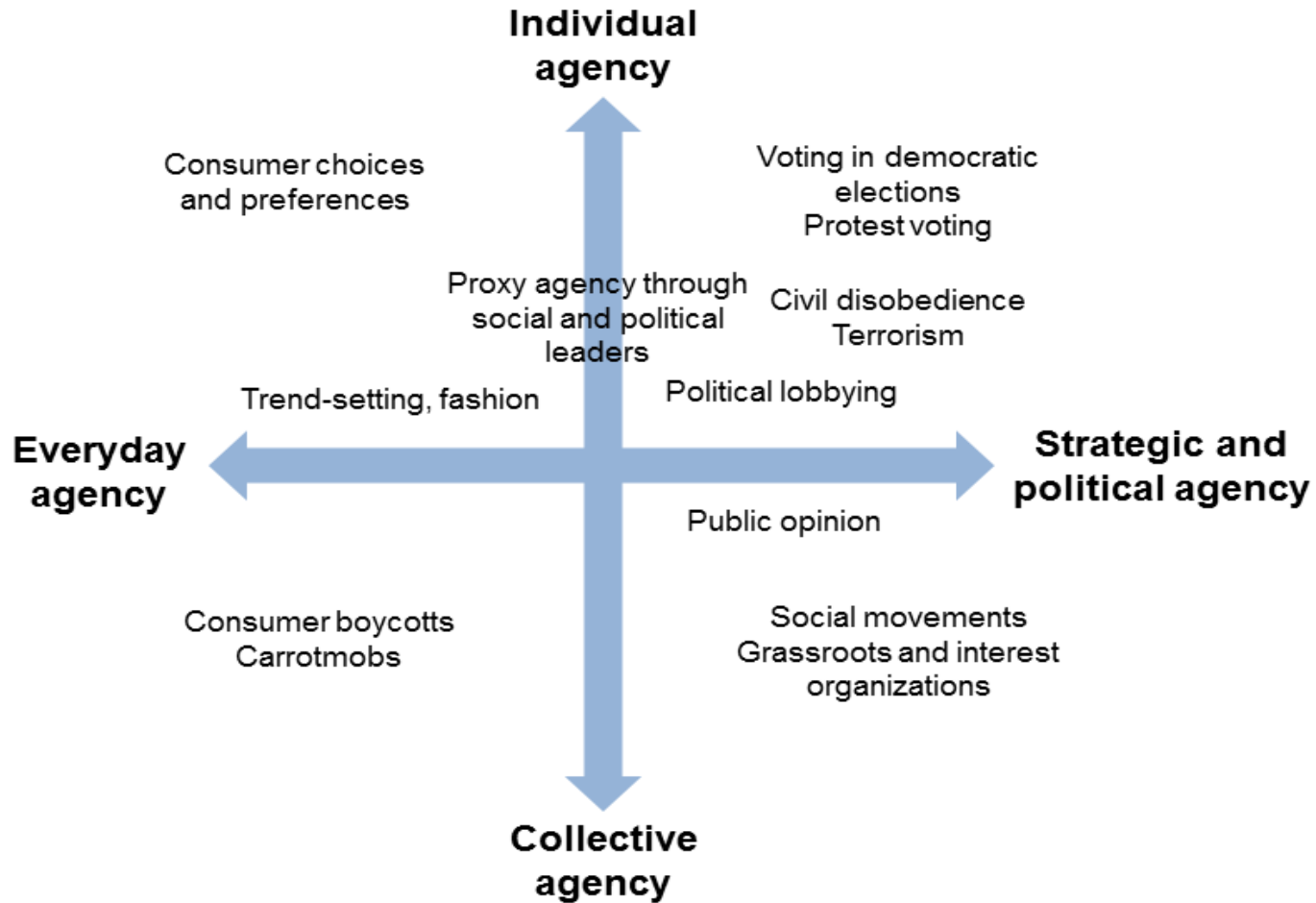
Inducing a global social tipping



Lessons learned

- 1. No silver bullet for rapid decarbonization; a silver buckshot is needed**
- 2. Technology alone will not lead to deep transformation;**
- 3. Values and norms are important for stabilizing the new emerging system;**
- 4. About 10-25% committed minority can tip the majority.**
- 5. Who is in the critical minority?**
 - Energy producers, energy ministers, teachers, educators, local governments, citizen groups, financial investors, producers, peer groups → **human agency**

Human agency dimensions



Global carbon inequalities

	Percent of global population	Percent of life-style CO2 emissions	The level of human agency
Socio-metabolic underclass	20%	2.5%	Extremely low
Socio-metabolic energy poor class	30%	7.5%	Low
Socio-metabolic lower class	30%	22%	Low individual and moderate level of collective agency
Socio-metabolic middle class	10%	19%	Moderate individual to high level of collective agency
Socio-metabolic upper class	9.5%	35.4%	Very high
Super-rich	0.54%	13.6%	Extremely high

Otto et al. (2020) Ecological Economics; Data sources: Oxfam 2008; Otto et al. 2019 Nature CC



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