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Letter in response to Otto et al (2020). Social tipping dynamics for stabilising Earth's climate by 2050. www.pnas.org/cgi/doi/10.1073/pnas.1900577117

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490 words and 10 refs.

Otto et al's (2020) evaluation of 'social tipping interventions' (STIs) for accelerating a global transformation to carbon-neutrality by 2050 is an important socio-political contribution to a debate that is all-too-often technocentric in focus. Otto et al's (2020) expert panel identified six social tipping elements (STEs) - within energy production/storage, human settlement, financial markets, norms and value systems, education and information feedback - as candidates with the greatest potential to overcome incumbent interests and other 'self-stabilising mechanisms' (p. 3) and trigger non-linear carbon reductions. However, in considering how this 'defining task for humanity' (p. 1) is to be achieved, a deeper analysis of social change processes and social movement theory would be beneficial. All of the proposed STIs require radical government action, either at national or local level. In labelling their STIs as 'starting points' (p. 3) in the transformation process, Otto et al (2020) thereby fail to ask: who initiates deliberate, radical change in the collective interest - does it tend to be government, the private sector or civil society? The evidence points to *civil society and social movements* as initiators of social transformations (Dunlap and Brulle, 2015; Dryzek, Norgaard and Schlossberg, 2011). Otto et al (2020) do refer to the role of social movements in changing social norms and values, citing historical examples such as the slavery abolition movement, but fail to understand social transformation as a dynamic social process that *results in*, rather than *begins with*, government intervention (Tilly and Tarrow, 2015). The process is better understood as a sequence of tipping points, that begins when a sufficiently broad, motivated coalition of people and organisations mobilise around a common cause, eventually reaching a critical 'mass' and 'momentum' for change (Centola, Becker, Brackbill and Bronchelli, 2018; Leach

and Scoones, 2015). Only then can politicians feel sufficiently emboldened to build their own coalitions that lead to government action (Willis, 2018).

As Otto et al (2020) state, STIs needs to be ‘contagious and fast-spreading’ (p.1). The urgency of the climate crisis requires social transformation at a rate many times faster than previous social movements (Smith, 2017). Otto et al (2020) invoke a *simple contagion* model numerous times. However, theoretical work on the diffusion of complex behaviours, leading-edge ‘big organising’ strategies, and case studies of social network-building over time demonstrate that a *complex contagion* model - characterised by local clusters of strong ties - is a better way of conceptualising this process (Centola, 2018; Crutchfield, 2018; Bond and Exley, 2016).

We therefore suggest that future evaluations of social tipping dynamics for climate stability should consider the process of social transformation as well as more complex patterns of contagion. The ‘starting points’ might then identify STIs focusing on, for example: how to mobilise and maintain broad coalitions for rapid change; how to communicate compelling narratives that appeal to diverse constituencies; and how to foster experimental ‘laboratories’ of community action whose successes may be easily learned and replicated.

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