

Transformations, Agency and Positive Tipping Points: A Resilience-Based Approach



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Abstract This chapter focuses on a social-ecological systems (SES) resilience-based approach to critically examine the relationship between tipping points and transformative change. Resilience science provides a framework for understanding the dynamics and interdependencies of complex systems and their ability to persist, adapt, or transform in response to change and uncertainty. Transformation refers to a deliberate and fundamental restructuring of a system or a set of relationships that hold a system in a particular state. We argue that the integration of a resilience-based approach to transformations can enhance the understanding of the link between tipping points and transformations, as well as the agency and capacities required to navigate them. In particular, we focus on how transformations research emphasizes the need to: better understand tipping points as one of many aspects of deeper transformation processes, include consideration of the distributed nature of agency and relationships, and how uncertainties will emerge in relation to shocks and disturbances which will surround tipping points. To achieve this, we drawing on the inter- and transdisciplinary scholarship related to transformations to sustainability including leverage points, social-ecological tipping points, disaster resilience, and case studies. We conclude that social tipping alone is insufficient; instead, there is a need for capacities to navigate the entire tipping process, or the full range of tipping dynamics, toward desired outcomes.

Keywords Transformations · Agency · Transformative capacities · Positive tipping points · Complex systems · Tipping dynamics · Resilience-based approach

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1 Introduction

The concept of tipping points, particularly positive tipping points, holds promise in the effort to comprehend and facilitate the rapid, large-scale, systemic transformations necessary to address significant global challenges, such as biodiversity loss and climate change (Sachs et al., 2019; Steffen et al., 2018). We refer to tipping points here as representations of critical junctures where a system undergoes a rapid and often irreversible shift in behavior or state in response to certain triggers or conditions (see for e.g. Milkoreit et al., 2018). Positive tipping points specifically pertain to collective actions, behaviors, or social movements that lead to substantial and positive societal change (Lenton, 2020; Lenton et al., 2022; Marten, 2009; Milkoreit, 2022; Milkoreit et al., 2018; Tabara et al., 2018).

It has been argued that understanding and harnessing positive tipping points can enable and catalyze transformative change at a broader scale (Tabara et al., 2021). The idea is that through identifying leverage points and interventions that can trigger cascading effects, we can unlock the potential for widespread adoption of sustainable practices, policies, and behaviors (Otto, Donges, et al., 2020; Sharpe & Lenton, 2021). The hope underpinning the existing arguments is that tipping points hold the potential to accelerate key transitions to more sustainable and resilient futures by overcoming inertia, generating positive feedback loops, and creating a momentum for change.

However, as the sub-field of scholarship focused on positive tipping points continues to evolve, there are valid concerns and critiques regarding the use of the concept, especially in considerations of achieving transformative change in complex systems. A major concern is the recognition that not all tipping points necessarily lead to transformative outcomes with some leading only to temporary or localized shifts without fundamentally altering the underlying system dynamics (Milkoreit, 2022). Additionally, the eventual outcomes of tipping points, and whether they truly lead to sustainability and justice or are considered “positive”, will be influenced by various factors that all shape transformative change processes. For instance, with a too narrow focus on technological innovations or a specific problem such as carbon emissions, “positive” change can have unintended and unexpected negative consequences in other parts of the system, including biodiversity and justice (Olsson et al., 2020). Moreover, whether underlying structural barriers are addressed, whether and what types of agency are mobilized, how inclusive decision-making processes are part of the “tipping”, and how well agents navigate complex social, economic, cultural, and ecological dynamics across scales all matter to the directionality of transformations processes (Geels & Ayoub, 2023).

More specifically, some of the existing research on positive tipping points has neglected the critical and specific roles of agency that have been well studied in other transformations scholarship; that is, whose agency and which capacities will be necessary once a system has reached a tipping point and starts to rapidly form new, self-reinforcing feedback loops. In resilience and transformation research terms, this is the threshold when a social-ecological system is reconfigured and

begins to move towards new attractors and stability basins, also referred to as the transition phase (Olsson et al., 2006). It is in the interplay between transformative agency and the broader system dynamics and feedbacks that will shape whether a tipping point is a negative or positive one. Moreover, we build on previous scholarship that has showed that conceptualizing social tipping as a single threshold alone is insufficient; instead, there is a need to consider a full range of tipping dynamics, including the capacities to navigate the entire tipping process (Geels & Ayoub, 2023; Herrfahrdt-Pähle et al., 2020; Milkoreit et al., 2018; Stadelmann-Steffen et al., 2021).

Therefore, recognizing both the promise and perils of this concept, we focus this chapter on a social-ecological systems (SES) resilience-based approach to critically examine the relationship between tipping points and transformative change. Resilience science provides a framework for understanding the dynamics and interdependencies of complex systems and their ability to persist, adapt, or transform in response to change and uncertainty. Transformation refers to a deliberate and fundamental restructuring of a system or a set of relationships that hold a system in a particular state. We argue that the integration of a resilience-based approach to transformations can enhance the understanding of the link between tipping points and transformations, as well as the agency and capacities required to navigate them. In particular, we focus on how transformations research emphasizes the need to: better understand tipping points as one of many aspects of deeper transformation processes, include consideration of the distributed nature of agency and relationships, and how uncertainties will emerge in relation to shocks and disturbances which will surround tipping points. To achieve this, we draw on the inter- and transdisciplinary scholarship related to transformations to sustainability including leverage points, social-ecological tipping points, disaster resilience, and case studies.

2 A Resilience-Based Approach to Transformations and Tipping Points

The resilience-based approach defines transformations as a distinct form of change, differentiating it from other types of change such as adaptation (Folke et al., 2010; Walker et al., 2004). Adaptation is understood as adjusting responses to changing external drivers and internal processes in order to remain in the current pathway of development, while transformation involves creating new pathways of development when ecological, economic or social conditions make the continuation of the existing system untenable (Folke et al., 2010).

The feedback loops or relationships involved in a transformation are those that make up a “system” (Tàbara, 2023) and its particular state (Hebinck et al., 2022). From this perspective, transformation will involve altering key relationships and feedbacks that influence the distribution and flow of authority, power, and resources,

and involve changes in the practices and processes that reflect and reproduce these structures, as well as shifts in the underlying norms, values, and beliefs that support these structures and processes (Moore et al., 2014, 2023). Furthermore, transformations involve the reconfiguration and reconnection of these elements in a way that is deeply connected to ecological systems across multiple scales (Moore et al., 2023). In essence, transformative change entails restructuring, reconnecting, and reshaping the meaning of relationships between individuals, as well as between humans and the ecosystems in which they are intricately embedded (Abson et al., 2017).

According to SES resilience theory, tipping points are critical points where a small change can have large and irreversible effects on the structure and function of a SES (Scheffer et al., 2001). Resilience scholars have focused on identifying and anticipating tipping points (Biggs et al., 2009), and to design strategies to avoid those that would create further unsustainability or injustice (Biggs et al., 2018) and how to navigate them (Olsson et al., 2006). This research also recognizes that some tipping points may be desirable or inevitable, and that they can create opportunities for transformation (Herrfahrdt-Pähle et al., 2020) if the system has been prepared for change.

Early theoretical frameworks of SES resilience describe complex adaptive systems as having landscapes with multiple basins of attraction and stable states, and multiple development trajectories (Scheffer & Carpenter, 2003), often pictured as a cup and ball model (Fig. 1). In the context of transformations, the notion of moving from one basin or state to another is central (Gunderson et al., 2022; Scheffer &

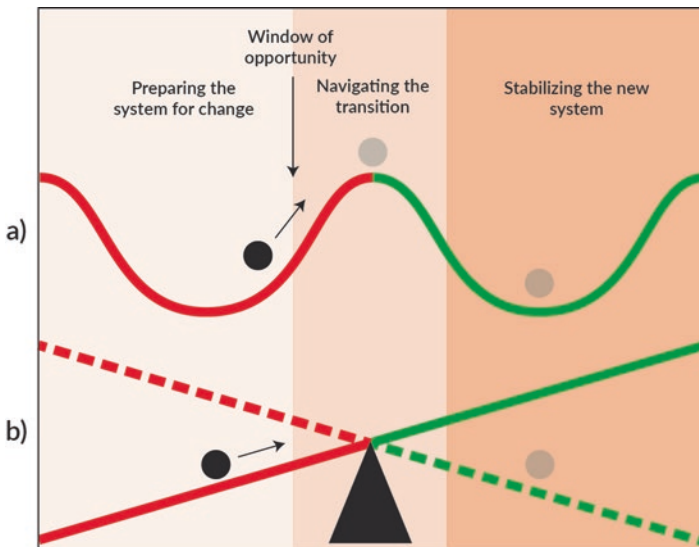


Fig. 1 Shows an early resilience-based transformations model, with a system that shifts from one basin of attraction to another, over a threshold (a) or tipping point (b) (Olsson et al., 2010). It also shows the three phases of transformation defined by the agency involved (1) preparing the system for change, (2) navigating the transition, and (3) stabilizing the new system (Image by: J. Gustafsson)

Carpenter, 2003). Each basin represents a distinct configuration of the system, held in place by specific sets of self-reinforcing feedback loops or relationships (human-human and human-non human) and organized around particular attractors.

Drawing on the concept of multiple basins of attraction, early frameworks in resilience-based transformations describe transformations as regime shifts between stable states, involving the crossing of thresholds or tipping points (Folke et al., 2005; Olsson et al., 2004, 2006, 2010) (Fig. 1). From this perspective, any transformation process will involve the dissolution of negative attractors and at least some of the feedback relationships associated with the dominant state, as well as the generation of new attractors, relationships, and feedback loops in alternative basins. Put more simply, transformations involve both “unmaking” and “making” of specific sets of relationships that make up a system (Feola et al., 2021; Moore et al., 2023).

Attractors can be metaphorically described as patterns that “attract” the behavior and self-organization of the system (van der Leeuw & Folke, 2021). In social-ecological systems, attractors can encompass physical conditions such as temperature, soil, or water, as well as hopeful and newly articulated visions, narratives, and imagined futures that are embedded in specific sets of values that can attract behaviors and institutions to organize around them (van der Leeuw & Folke, 2021). Attractors can vary in strength and are represented by the depth of each basin. A deep basin signifies a strong attractor that is resistant to transformation even when the system experiences disturbances, while a relatively shallow basin can be more easily tipped when disrupted (Holling, 1973; Scheffer & Carpenter, 2003).

At the threshold or tipping point between two basins, the metaphorical “ball” could roll in various directions across a landscape of multiple possible basins of attraction (Herrfahrdt-Pähle et al., 2020; Hill & Kolmes, 2023; Tabara et al., 2018) (Fig. 2). This means that trajectories of transformation might lead towards positive attractors, such as peace, sustainability, and justice (Donges & Barfuss, 2017;

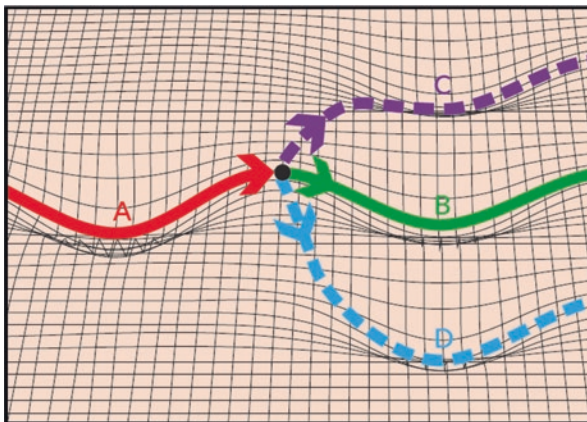


Fig. 2 Illustrating multiple system trajectories represented by multiple basins of attraction that the “ball” can roll into in the transition phase, due to many competing, latent attractors (C (purple) and D (blue)), not shown in the two-dimensional Fig. 1 (from Olsson & Moore, 2024) (Image by: J. Gustafsson)

Elmqvist et al., 2019; Westley et al., 2011). However, the ball could also revert to the previous basin or even gravitate towards different versions of negative and sometimes latent attractors (Malka, 2021). The outcome of the transformation process depends on the complex interplay of various factors and the contestation of competing attractors within the system.

Studies using SES transformations frameworks have examined the interplay between tipping dynamics and shocks and crises and how these disruptions have the potential to create pivotal moments, or opportunity contexts when significant transformations become possible (Moore et al., 2023; Olsson et al., 2004). As an example, Hebinck et al. (2022) examine the interplay of factors shaping the coal and carbon-intensive energy regimes that are the focus of many transformation efforts. Additionally, Herrfahrdt-Pähle et al. (2020) examine the role of political crises and the range of cognitive, structural and agency factors that interact across multiple scales and multiple phases of a transformation. SES transformations frameworks treat tipping dynamics as mainly occurring in one specific phase in the transformation process: the transition phase (Fig. 1a), although these will be shaped by what happens during the preparation and institutionalization phases. The transition phase can be characterized as a period of uncertainty and surprise, representing a state of limbo between systems and basins of attraction (Olsson & Moore, 2024). During this phase, characterized by the crossing of thresholds and tipping points, the dissolution of old feedbacks and the formation of new feedback loops are occurring rapidly, and the dynamics of the system are in flux. Within this phase, as previously stated, there is the potential for both positive outcomes and negative consequences, including periods of intense conflict and violence (Hartwell, 2007; Stedman, 1997).

Recognizing the transition phase represents a period of complexity and heightened uncertainty (Moore et al., 2023), and diverse agency including the full range of “strategic moves and countermoves, interactions learning, reflexivity, and cognitive changes” (Geels & Ayoub, 2023, p. 2) that will interplay and co-evolve with ecological change, scholars have argued for the need to move away from treating tipping points as singular thresholds or control parameters (Geels & Ayoub, 2023; Milkoreit et al., 2018; Stadelmann-Steffen et al., 2021). We adopt this approach here and argue that understanding the possibilities for positive tipping dynamics for peaceful and just transformations towards sustainable and equitable futures requires a deliberate focus on the role of agency in navigating the uncertainties and complexities inherent in the transition phase of transformative change.

3 The Role of Agency and the Capacities for Navigating Tipping Dynamics

Having summarized the relationship between SES perspectives on transformations and tipping dynamics, this section dives deeper into the role of agency in relation to transformative tipping dynamics. By exploring how agency interacts with and influences the threshold and tipping dynamics within a system, we can better understand

its potential to navigate transformative change and offer insights into how to foster positive outcomes and build capacities that can help guide systems towards a more sustainable and equitable future. We focus on three issues that a resilience-based approach to transformations highlights with respect to agency and tipping dynamics: (1) that agency is distributed and no single actor or agent can control a complex system or tipping point, (2) transformation is a nonlinear process that involves more than diffusion of specific technologies, behaviours or practices, and (3) tipping dynamics will lead to emergence, but will also be subject to crisis, disruption, and surprise as these are key features of any complex system change process and agents will need to navigate these as well as the changes associated with tipping.

3.1 Distributed Agency and the Illusion of Control of Tipping Points

In the resilience-based transformations approach, a rich accounting of transformative agency has been established. Early efforts to connect positive tipping points, transformation, and agency were influenced by scholarship on resilience conducted by Berkes et al. (2003), Berkes and Folke (1998), Gunderson et al. (1995), Gunderson and Holling (2002), Ostrom (1990), and Westley (1995, 2002). These endeavors encompassed both theoretical and empirical work, incorporating case studies such as Kristianstads Vattenrike (Hahn et al., 2006; Olsson et al., 2004), Chile coastal fisheries (Gelcich et al., 2010), and the Australian Great Barrier Reef (Olsson et al., 2008). These studies shed light on the dynamics of transformative change, capturing both slow and fast dynamics of such change, and how complex adaptive systems can rapidly and abruptly change development trajectories at specific point in time, and under certain conditions. They drew upon concepts such as critical transitions and regime shifts (Scheffer et al., 2001), bifurcation points (Ludwig et al., 1997), bifurcation policy (Olsson & Folke, 2001), window of opportunity (Kingdon, 1995), critical junctures (Baumgartner & Jones, 1991), and punctuated equilibrium (Repetto, 2006). Notably, the early work highlighted the role of agency and the necessity of specific capacities for transformative change, including “tipping-point leadership” (Folke et al., 2005; Olsson et al., 2006).

Together with more recent contributions (e.g. Benessaiah & Eakin, 2021; Bennett et al., 2016; Drimie et al., 2018; Nilsson & Paddock, 2014; Pereira et al., 2020), this scholarship shows that the mobilization of transformative agency will relate to the capacity of actors to navigate the direction and outcome of change processes in complex systems. Agency is crucial for navigating tipping dynamics and transformation between different basins of attraction, as it determines how actors perceive, respond to, and shape the system in the context of uncertainty and surprise (Folke et al., 2005; Olsson et al., 2004, 2006; Westley et al., 2011, 2013). Transformative agency can be enhanced or constrained by various factors, such as power relations, institutions, values, and knowledge (Benessaiah & Eakin, 2021).

Perhaps most importantly to tipping dynamics however, is that agency has been shown to be collective and distributed across space and time, and involves coordination and collaboration among different actors across different phases of a transformation process (Moore et al., 2018; Olsson et al., 2006; Rosen & Olsson, 2013; Westley et al., 2013). The notion of distributed agency however, has not yet been well considered in relationship to tipping dynamics (Otto, Wiedermann, et al., 2020).

Given that an SES resilience-based approach to transformations treats existing system states as related to broad sets of relationships and dynamics, it is worth remembering that some of those are path dependent and can contribute to traps (Carpenter & Brock, 2008; Haider et al., 2018), while other dynamics and relationships may be emergent and not something that an individual or group have set out to deliberately create. Too often, problematic dynamics, system states, or traps are treated as something held in place only by powerful “others”. Inevitably, that leads to scholarship focusing on the roles of different actors, and the likelihood that those actors may have influence on a tipping point or transformation. For instance, scholars have analyzed civil society and their role in grassroots change (Frantzeskaki et al., 2018), shadow networks and their work to influence decision-makers (Olsson et al., 2006; Sendzimir et al., 2008), and keystone actors that hold positions of wealth and power that would need to be redirected for the trajectory of the system to be moving towards sustainability and justice (Österblom et al., 2017).

Although understanding the different roles that different sets of actors play, and when, is essential for understanding transformation processes, the risk is that some scholarship can tend towards discussing transformations and tipping dynamics in deterministic terms. The notion that either wealthy corporate elites or civil society are somehow able and more likely to control a complex phenomenon such as transformation or a tipping point ignores what is understood about the lack of control associated with complex systems. Transformation will involve some deliberate exertion of agency, but it will be combined with emergent, nonlinear dynamics that cannot be predicted nor “managed” before or after they emerge (see for e.g. Mintzberg & Westley, 1992) and will require constant re-calibration and navigating. As Westley et al. (2006) recognize, we are all the system; the system is not just something done to us as agents, nor is it held in place simply by one set of actors or one specific structure. At best perhaps, agents can develop reflexivity sufficiently enough to begin to be able to “see” the dynamics as they emerge around them (Moore et al., 2018).

3.2 Transformations as Complex, Nonlinear Processes

The idea of agency as distributed across space and time scales also raises issues for how tipping points scholarship can model social tipping dynamics. Existing analyses are explicit in recognizing complex transformative change processes will be nonlinear (Lenton, 2021; Otto, Donges, et al., 2020). However, social tipping point modelling has tended to rely on contagion and diffusion theories for the rapid

scaling out of technologies (e.g. zero emissions technologies) to hypothesize whether it is possible to make a difference large enough to contribute to mitigate further changes to the climate (Otto, Donges, et al., 2020). While these are useful for understanding the potential impacts of technology adoption by a specific number of people, these models tend to treat transformation as relatively linear, and further neglect that transformation processes will involve far more than adopting a few technologies, and the much more nuanced insights transformations research has already established about agency in nonlinear processes (Smith et al., 2020).

As stated, we follow Geels and Ayoub (2023) in treating tipping more as a range of dynamics rather than a singular point, and we place these sets of dynamics as one aspect occurring within the transition phase of a transformation process (Herrfahrdt-Pähle et al., 2020). Although research has shown that the capacities of this phase depend on the capacities of the preparation phase (including readiness and leveraging) and stabilization phase (including consolidation and routinization) (Herrfahrdt-Pähle et al., 2020; Olsson et al., 2004, 2006),—that is, the capacities of the different phases will affect one another—we focus here specifically on the agency and capacities of the transition phase that are crucial for navigating positive tipping dynamics.

If the transition phase typically involves a rapid shift in at least some of the systems' behaviors, rules and regulations, and values, leading to profound changes in relationships and rapid formation of new self-reinforcing feedback loops, then the overall tipping dynamics can be understood as representing that critical time where shifts in feedback loops may accelerate both the making and unmaking processes of transformations. In transformative change, the unmaking process is particularly crucial as it may facilitate tipping and moving through the transition phase (Olsson et al., 2014). The resilience-based approach for example, recognizes the pivotal role of agency in reducing the resilience of undesired systems that perpetuate injustices and unsustainability (Elmqvist et al., 2019; Olsson et al., 2014; Walker et al., 2002), ultimately aiming to dissolve self-reinforcing feedback loops that maintain such systems in a particular basin of attraction. Without adequate attention to the unmaking aspects of transformations, which will happen in the preparation phase and throughout a transformation process, significant portions of the status quo system may persist, posing risks of cooptation for initiatives or interventions aimed at enabling transformative change and limiting the depth of change that may be possible.

One capacity required in the “unmaking dimension” is rapid hospicing, which involves honoring, grieving, and addressing the losses and legacies of the dominant system (de Machado Olivier, 2021). Another capacity relevant for both dimensions is systems reflexivity, which entails recognizing and adapting to the constraints and opportunities shaped by existing institutions and structures during the transition phase (Moore et al., 2018).

Apart from the dissolution aspects of transformative change, capacities will also be needed for establishing alternative attractors (van der Leeuw & Folke, 2021). For example, capacities for envisioning and self-organizing are essential in the “making dimension” to support the emergence of new states and attractors (Hölscher & Frantzeskaki, 2020; Moore et al., 2018). Similarly, imagination is likely to play a

critical role in the making of alternative attractors and ultimately, alternative futures (Galafassi et al., 2018; Moore & Milkoreit, 2020, Pereira et al., 2018). Recognizing the interconnectedness of social-ecological systems, strengthening the connection to the biosphere also becomes a crucial capacity. It can be a part of healing approaches, revitalizing identities, cultures, languages, biocultural practices and more that have been damaged through conflict or marginalization by the previous dominant system (Westoby et al., 2022).

3.3 Navigating Crisis, Shocks, and Disturbances Surrounding Tipping Dynamics

As mentioned earlier, the transition phase, and the tipping dynamics, of any transformative change can be the most turbulent and challenging. Understanding the role of agency and the capacities necessary for navigating for example the conflict and violence associated with this phase is crucial. In Olsson and Moore (2024), we use peacebuilding as an example of a transformative process that offers a refined conceptualization of the transition phase. This conceptualization incorporates positive tipping dynamics and provides insights that can guide further exploration of specific agency and transformative capacities, determining which aspects of agency and capacities are important and why. These capacities encompass methods to secure inclusivity and representation and the ability to navigate “backlash” dynamics that often arise in transformative change efforts, including conflicts and violence.

An illustrative example of the kinds of dynamics that can emerge surrounding tipping involves any number of social movements that have arisen but are not yet directly linked to a transformation. Acts of resistance, such as protests or campaigns by social movements are often critical in effectively weakening the attraction to the dominant governing regime’s basin. However, while such acts are important, they can focus more capacity on weakening the existing attractor, which can be limiting if it is not also linked up to other efforts that are strengthening capacities to envision and build attraction towards alternative states or navigate the liminal space between them. In these instances, although a social tipping “point” can theoretically be reached regarding the rejection of the existing system state, the broader tipping dynamics have not yet lead to transformative change. This example also highlights the need for capacities to deal with latent attractors or generate new attractors during the transition phase and the tipping dynamics. It is important to recognize that various efforts by different groups may represent different and sometimes competing support for different attractors which may affect the trajectory during and after the transition phase.

Literature on conflict resolution can also be useful to combine with the resilience-based transformations approach to better understand the dynamics that can emerge during the transitions phase in which tipping dynamics occur (de Coning, 2020). Scholars have described instances of violence that erupted in response to

transformative change, such as the types of violent opposition that can erupt during national transitions from conflict and dictatorships to peace and democracy (see for e.g. Edles, 1998). The evidence indicates that there can be a potential for backlash to occur when societies begin to tip in a particular direction or when they even show a potential to do so as the preparation of the system for change becomes obvious to those that comprise the system (Olsson and Moore 2024). Again, having capacities to navigate such dynamics are as crucial as building a social tipping if transformative change is sought after.

Resilience scholars have also studied another key aspect of tipping dynamics—the role of crisis in transformations. Crisis can include economic, ecological, or socio-political shocks, natural disasters, and pandemics (Benessaiah & Eakin, 2021; Brundiens, 2020; Herrfahrdt-Pähle et al., 2020; Moore et al., 2023; Olsson et al., 2004). Crises and polycrises (several interacting crises) can serve to create different opportunity contexts for transformation, and sometimes can weaken the unwanted attractor and make the basin more shallow and more susceptible for “tipping”. However, crisis can emerge at any time in the transition phase—as well as during any other phase of a transformation process—which will inevitably add to the complexity of the tipping dynamics. As crises can lead to a wide range of outcomes, it is crucial that capacities for navigating positive tipping dynamics will need to also include abilities to continually respond to additional, unanticipated crises or disturbances that may arise during the transition phase.

In the precarious transition phase of any transformation process, which determines whether a system moves towards sustainability and justice, it has been argued that the development of a temporary, shallow basin of attraction can be crucial for navigating positive tipping dynamics (see Fig. 3) and allow for new attractors to be collectively defined and new relationships and feedback loops to form. Key capacities would involve creating the conditions necessary to allow for this and to deal with the uncertainties, volatility, and resistance that can emerge in any transition phase. It is essential to recognize that the transition phase, and the tipping dynamics itself, represents a state, albeit a more temporary one compared to the other phases.

In addition, from a resilience-based transformations perspective, ensuring this temporary state can provide space to foster new attractors requires having the capacities to grapple with two other aspects of transformative change. The first is having the capacities to consider and even anticipate cross-scale dynamics, or teleconnections—those hidden relationships that can exist across problems and vulnerabilities at different spatial and temporal scales (Adger et al., 2009; Liu et al., 2015). Such a capacity would be needed to ensure that any future attractors are not serving to reinforce issues that existed in the previous dominant state, nor creating new unsustainable or inequitable dynamics that might not have otherwise been anticipated.

Second, capacities will be needed to bring forward aspects of the previous dominant system that are needed for any future. As just one example, certain forms of knowledge and ways of knowing, such as Indigenous ways of knowing and knowledge, provides essential elements for continuity, recognizing specifically that continuity does not mean static (Apgar et al., 2015; Bartlett et al., 2012; Prosper et al., 2011; Tobias & Richmond, 2014). Likewise, Lansing (2009) documented the roles

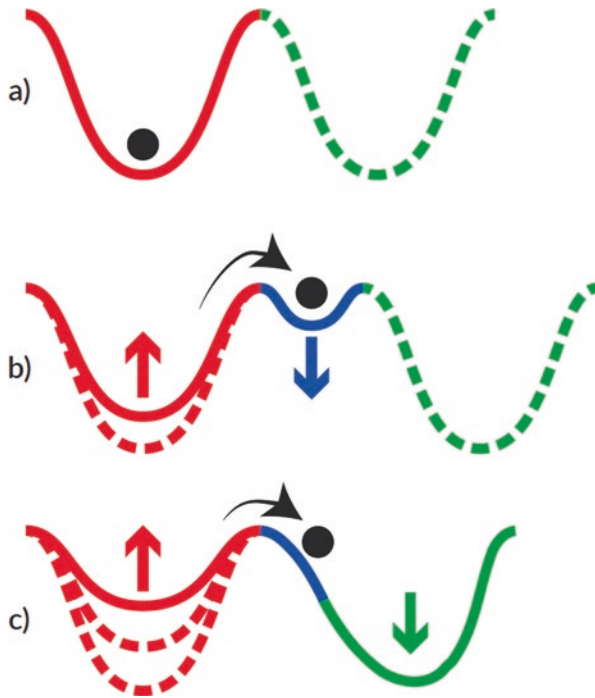


Fig. 3 (a) The red basin of attraction or “cup” is the current system state, with negative attractors, that needs to be transformed. The dotted green line is the future basin of attraction and the imagined, transformed state of the system, with new, positive attractors. (b) Since the transition phase can be difficult to navigate (due to high level of uncertainty and surprise and latent, competing, and negative attractors), agency and transformative capacities can help create a temporary, shallow basin of attraction (in blue). Thus, it can provide a liminal space when moving from one state to another. (c) This can create enough time and space to allow for new attractors to be collectively defined, the navigation of tipping dynamics, and new relationships and feedback loops to form (from Olsson & Moore, 2024) (Image by: J. Gustafsson)

of spiritual leaders who maintain the stories, practices, and rituals for ways of knowing and connecting with nature in the relationship between Balinese water temples and rice irrigation. Thus, Indigenous and local, place-based or context-specific knowledge, institutional memory, social-ecological memory (Andersson and Barthel, 2016), and more all shape the dynamics that may follow tipping and can provide context and experience for reorganization after periods of instability and change (Olsson et al., 2022).

Such a perspective places less emphasis on finding the perfect “seed” or set of initiatives to grow to a large scale, which has been the focus of current social tipping point modelling, and moves away from early understandings of innovation that rely on linear, diffusion theory. Instead, the focus is more on creating the potential for different building blocks and combinations within a system that help break path

dependence and reorganize around a new attractor during this temporary transition state.

4 Conclusion

Recent scholarship has described how early scholarship used the concept of social tipping points too loosely and more as a metaphor, raising major questions about the complex social dynamics that were glossed over by positive orientations to tipping points (Milkoreit, 2022; Otto, Donges, et al., 2020; Smith et al., 2020). We respond to that growing awareness by drawing on insights from resilience-based approaches to transformations, suggesting the findings in this sub-field of resilience scholarship could help better understand the capacities needed to navigate the momentum that tipping dynamics involve.

We begin by describing transformations as a multi-dimensional and multi-phased process (see Olsson et al., 2014), arguing this understanding of transformations raises questions about what happens beyond tipping points, and even, what happens while tipping dynamics are underway. As Milkoreit (2022) describes, a significant increase in the number of articles related to social tipping points has emerged in relationship to climate change solutions. While the risks that climate tunnel vision creates have been acknowledged elsewhere, these same risks appear applicable to social tipping point research. Climate solutions should not be disconnected from other issues such as biodiversity, and should not be considered in isolation from the broader dynamics of social-ecological transformations. As part of the resilience-based approach to transformations, we also urge scholars working to understand social tipping dynamics to better account for both phasing out of existing dominant feedbacks and relationships and the generation of new, alternative attractors as critical to the phase in which tipping occurs. A tipping point that can contribute to a new, stabilized state will depend on how fast or slow the unmaking dynamics may play out, and how much momentum for the new attractor has been established—if neither of these has occurred, it is unlikely that any tipping dynamics would lead to transformation.

The making and unmaking processes will rely in large part, on agency. Based on existing conceptual and empirical scholarship, we suggest that understanding the role of social tipping dynamics within broader transformation processes requires consideration of three key aspects of agency. One, social tipping dynamics research needs to move away from emphasizing the role of individual agents and their adoption of specific technologies, behaviours, or practices, since no single actor controls a complex system. We suggest future research needs to better grapple with the distributed nature of agency in complex change across multiple scales. Two, in moving away from the idea of scaling out a specific technology, behaviour, or practice, we suggest stronger consideration be given to what transformations has already established about the capacities needed for both the making and the unmaking of different basins of attraction, or different system states. Three, given the uncertainties and

risks of backlash and resistance during the transition phase, we urge a stronger consideration of the dynamics of surprise, uncertainty, disruption, and crisis in relationship to tipping dynamics. Surprise, uncertainty, disruption, and crisis have all been central to resilience-based transformations research, but are often neglected in current social tipping point analyses despite the fact that agency and strategies will be needed for stabilizing the tipping point and guiding the trajectory towards certain attractors over others.

Finally, while we point to specific capacities needed to navigate the tipping dynamics and the broader transition phase we consider them to be part of, we note that much more research is required to both further empirically gather evidence for and against specific capacities, and to give consideration of questions that currently remain unanswered. While we state that transformations can be shaped but not controlled by a single actor group, substantive theorization about accountability and responsibility of different actors during tipping is still urgently needed.

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