CHAPTER 1

Introduction

> A paradigm governs, in the first instance, not a subject matter but rather a group of practitioners. Any study of paradigm-directed or of paradigm-shattering research must begin by locating the responsible group or groups.
>
> – Thomas Kuhn

> If a [thought collective] is quite sizeable and lasts for many years in a uniform mood . . . it will produce solidarity and the feeling of mutual dependence among its members. They will see the same characteristic overall forms, they will believe the dogmas of the collective philosophy of life, they will think using solely the categories of a certain style. For, 'What thinks in a man, is by no means himself, but his social community.'
>
> – Ludwik Fleck

In 2014, on a sun-drenched patio in the south of France, I performed the rite of passage marking my entrance into the Resilience Alliance's secret scientific society. The Resilience Alliance had been the most influential theory group in sustainability science in the preceding decade, publishing hundreds of articles in the world's top scientific journals, launching half a dozen research centers, convening international scientific conferences, influencing environmental management at global scales, and sparking a controversial scientific movement that transformed the content of ideas and patterns of social relationships among scholars in their field. I was invited to join their secret society after having spent the previous twelve years traveling by bus, jeep, ferry, train, and tiny bush plane to remote locations in Africa, Europe, Australia, and North America to interview Resilience Alliance members and observe them collaborate. I became a friend and confidant, joining their late-night happy hours, participating in their contests and rituals, residing at their research centers, sleeping in their homes, and speaking with them about their professional triumphs and personal tragedies. This ethnography represents the first time that a

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sociologist has been able to observe a theory group firsthand. This book relates the Resilience Alliance's life course and the social and intellectual processes that shaped its growth, development, and transformation.

Theory groups are small research groups who develop a new scientific theory and work together to promote its acceptance by the scientific community. They are prime movers across the history of science. Famous examples include the group of French mathematicians that published collectively under the name "Nicolas Bourbaki,"[1] who developed their vision for mathematical structuralism during retreats at remote locations in the French countryside. They also created their own secret scientific society, engaged in pranks such as applying for Bourbaki to become a member of the American Mathematical Society,[2] and practiced ritualized behavior like mock weddings and funerals that instilled the solidarity and friendship needed to cultivate an unshakable faith in their ideas and mission to transform mathematics (Aczel 2009; Mashaal 2006). The Copenhagen physics group that developed quantum mechanics theory is another notable case. Led by charismatic leader Niels Bohr, this group retreated to the Danish countryside to develop their ideas in isolation from the physics community, building group cohesion and commitment by hiking and sailing together. They also organized an annual scientific conference to help spread their ideas that blended serious scientific thinking with collective fun, such as having attendees produce cartoon histories of quantum mechanics starring Mickey Mouse or acting out modified scenes from Goethe's *Faust* in which they viciously mocked opponents like Albert Einstein (Bohr, of course, played God)[3] (Kojevnikov 2020; Segre 2008).

The Resilience Alliance (hereafter, "RA") created its influential theory of social-ecological change through a collaborative process that they called "island time." RA members were globally distributed, so they developed their ideas through a series of meetings each held on a different remote island (or its equivalent) in far-flung locations scattered around the world. Island time was based on a distinctive set of social practices that RA's

[1] That Bourbaki was a collective of mathematicians was an open secret, as were its members. Bourbaki's prestige was such that being identified informally with the group was an honor and members were happy to publish under the collective pseudonym. Doing so had the added benefit of protecting individual members from criticism from their critics and competitors (Halmos 1957).

[2] They were rebuffed and asked to apply for an institutional membership because they were widely known to be a collective entity. Bourbaki responded by claiming (falsely) that the editors of *Mathematical Reviews* were themselves fakers hiding behind a collective pseudonym (Aczel 2009).

[3] For example, they mocked Einstein's failed unified field theory by making him the king leading an army of fleas: "Half naked, fleas come pouring/From Berlin's joy and pride/named by the unadoring:/Field theories – Unified."

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charismatic intellectual leader, world-renowned ecologist Crawford Stanley "Buzz" Holling, had honed over a celebrated lifetime of leading scientific groups. Meeting in social and physical isolation from the rest of the scientific community helped RA members overcome the constraints and conservatism of their home institutions and disciplines while promoting the mutual focus and deep forms of immersive intersubjectivity required for collective theorizing. Emphasizing informality and fun, secret rituals and secret societies, and group activities such as swimming and hiking together in breathtaking natural environments facilitated group bonding, inspired grand ideas and grand ambitions, and instilled the conviction that RA could succeed in its audacious quest to transform sustainability science. The theory that they developed on those islands continues to strongly influence sustainability science today, including the well-known concepts of "resilience," "social-ecological systems," "regime shifts," "panarchy," "the adaptive cycle," and the "planetary boundaries framework." Resilience theory also shaped global environmental policy through its use within internationally influential organizations such as the World Bank, the United Nations, and the World Business Council for Sustainable Development, and its ideas have informed the management of iconic ecosystems ranging from the Grand Canyon to the Great Barrier Reef.

Research on theory groups has been rare despite their massive influence on science and society. The most influential research on the topic has used social network analysis to analyze the structure of social relationships among group members but has not considered the small group dynamics that enable the collective articulation and promotion of a new scientific theory. This book differs from past research by adopting a group dynamics approach, combined with ideas from social movement studies and the sociology of religion, to illuminate the emergent social processes and social practices that facilitate group theorizing, and to examine how contact between a theory group and the scientific community affects its culture, structure, and creative capacity. This approach complements network theories of intellectual change by highlighting the local forms of social interaction that underpin and structure the broader scientific networks in which theory groups are enmeshed.

Resuscitating interest in theory groups is critical in a time when we desperately need the combined expertise of diverse research groups to help address wicked social and environmental problems. Studying theory groups advances understanding of the conditions under which transformative scientific creativity can flourish or decay while helping to inform the rising interest among universities and science funding agencies in

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understanding how to best organize scientific collaborations for maximal creativity and social relevancy. Researching theory groups also advances understanding of the local production and contestation of scientific knowledge, the rise and fall of scientific theories and intellectual movements, and the micropolitics of scientific disciplines. Furthermore, while sociology has witnessed an explosion of books and articles on theorizing, most are metatheoretical statements attempting to define "theory" and "theorizing" (e.g., Abend 2008; Krause 2016; Rasmussen and Johannessen 2023) or offer tools to help novices develop new concepts and theories (e.g., Jaccard and Jacoby 2020; Swedberg 2014a; Timmermans and Tavory 2022). Empirical research on the social construction, contestation, and transformation of scientific theories is rare, and research on group theorizing and the discovery contexts and social practices that can give rise to it is rarer still. Studying theory groups thus provides crucial research materials for moving beyond idealized notions of theorizing to the empirical realities of theorizing as a contingent social process influenced by local social contexts, group dynamics, and conflictual interactions with competitors and detractors. Finally, researching theory groups contributes to the burgeoning sociology of creativity, which has recently emerged as an independent area of inquiry devoted to understanding the general mechanisms of creative action across cultural fields (Corte *et al.* 2019; Godart *et al.* 2020; Wohl 2022).

Theories and Theory Groups

Theory groups are small, tightly networked, activist research groups who produce and promote a new theory and research program that deviates markedly from established scientific practice and potentiates new specialties and disciplines (Mullins 1973; Parker and Hackett 2012).[4] They are engines of scientific creativity and change. Developing and promoting new scientific theories involves overlapping social processes requiring substantial time, commitment, energy, and access to scarce resources (Fleck 1981; Frickel and Gross 2005). These are best realized in small groups that can serve as platforms for gaining assets, enhancing visibility, and engaging in collective action (Benford and Hunt 1992; Corte 2012; Fine 2012, 2021). It usually takes a *group* to flesh out a generative scientific vision – to

[4] Theory groups are a specific instance of the broader phenomenon of "coherent groups" – small groups of researchers oriented toward common intellectual goals who work together in opposition to current intellectual trends. Theory groups innovate by constructing a new generative scientific theory, but coherent groups can also be based on new scientific methods or new data sources (Bechtel 2012; Polillo 2020).

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challenge and synthesize, to refine and specify, to promote the new theory, and to defend it against skepticism. Theory groups produce transformative science with the potential to radically alter existing understanding. They also incubate and enhance scientific talent, accelerating career trajectories and propelling some members to the status of scientific elites.

Theory groups were among the first social phenomena to be researched by sociologists of science. Ludwik Fleck and Robert K. Merton, towering figures whose work presaged science studies by decades, identified theory groups ninety years ago within the inaugural European and American contributions to the sociology of science. Fleck's classic, *Genesis and Development of a Scientific Fact* (Fleck 1981 [1935]), analyzes "thought collectives" in ways that are directly analogous to theory groups – closely collaborating small research groups who through repeated interaction and social bonding develop a characteristic mode of theorizing and conducting scientific work. Repeated interactions and debates within the collective inculcate abiding faith in the group's ideas and lead to the creation of an emotionally toned "thought style" among group members comprising a shared cognitive framework with common methods, evidentiary standards, writing styles, and orientations toward research problems. Furthermore, science does not advance through slow accumulation but through sudden shifts in perception occasioned by new thought collectives. More radically, Fleck claims that emotions also determine the flow of scientific thinking and that what a group member considers to be logical, true, and objective is determined by the distinctive cognitive and emotional character of the thought collective. Scientific "truths" are not objective facts; instead, scientific knowledge is true relative to the collective in which it originates.

Merton's dissertation research, *Science, Technology and Society in Seventeenth Century England* (Merton 1970 [1937]), includes theory groups as a key element contributing to the rise of science as a distinctive social institution wherein the quest for knowledge is justified as an end in itself. Science, he argues, was enabled by an emotionally infused "complex of social attitudes which, for varying reasons, religious, economically utilitarian and idealistic, was favorable to scientific interest" (Merton 1970 [1937], 78) combined with a growing network of talented individuals and a maturing experimental method. But behind these larger social forces was the strategic work of "nuclear groups" such as the Hartlib Circle and Whadam Group, who through prolonged interaction developed a vision for how science should be performed and professionally organized. These groups and others like them provided the social kernels of The Royal Society – the oldest continuously existing scientific society.

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Despite the penetrating brilliance of Fleck's and Merton's early contributions, few have built upon this foundation. Thirty years would pass before the sociology of science became an established research specialty and theory groups once again became an object of interest.[5] Thomas Kuhn's masterpiece, *The Structure of Scientific Revolutions* (Kuhn 1962), revived interest in the topic. Like Fleck, Kuhn argued that science is not a cumulative process in which truth is gradually revealed over time. Instead, phases of "normal" scientific progress are periodically upset by episodes of revolutionary science that overturn established paradigms. Unlike Fleck, Kuhn did not specify how new paradigms emerged or who within the scientific community produced them. Sociologists of science, however, had begun using the emerging techniques of bibliometric coupling and co-citation analysis to diagram the social structure of the scientific community (e.g., Crane 1969b; De Solla Price and Beaver 1966; Mullins 1968). Their findings were striking: In every field they examined scientists selectively associated into small world groups and networks that constituted their primary collaborators and reference groups. Moreover, some of these tightly bounded groups produced new theoretical perspectives that broke sharply from traditional ways of understanding scientific work.

By the second edition of *Structure*, sufficient evidence had accumulated to confirm the existence of theory groups. Kuhn (1970, 183–187) addressed them directly in a postscript entitled "*Second Thoughts on Paradigms*." He notes that he should have paid more attention to the scientific groups that produce paradigms, commenting: "Communities of this sort are the ones that [SSR] has presented as the producers and validators of scientific knowledge. Paradigms are something shared by members of such groups" (Kuhn 1970, 178). Also, "If the term paradigm is to be successfully explicated, scientific communities must first be recognized as having an independent existence . . . In fact, the identification and study of scientific communities has recently emerged as a significant research subject among sociologists" (Kuhn, 1974).

Kuhn (1970) argued that theory groups do not merely produce scientific theory in the form of postulates or law-like rules such as $E = mc^2$ or $a^2 + b^2 = c^2$. That would be far too limited in scope to have the procreative capacity to launch a new scientific movement. Instead, theory groups produce an overarching metatheoretical framework that enables a specific way of perceiving and analyzing. This is referred to as "T^5" theory

[5] Merton's 1957 presidential address to the American Sociological Association is often noted as the launching point for contemporary sociology of science.

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within Abend's (2008) well-known typology of theories – a *weltanschauung* providing a broad orientational perspective for interpreting the social or natural world. Kuhn notes that such theories typically contain four facets. The first is symbolic generalizations serving as heuristic devices for developing research questions and providing solutions to them. The second is a set of shared commitments among group members to general models of reality that provide them with permissible analogies or metaphors and help determine acceptable explanations. The third is a shared set of values used to create and judge solutions to scientific problems. Finally, there are well-known exemplars of successful research conducted in the group's style that serve as an orienting touchstone for group members.[6]

In 1972, Nicholas Mullins began a series of investigations into theory group development. In *The Phage Group and the Origins of Molecular Biology* (Mullins 1972), Mullins described the origins and development of the theory group that discovered the helical structure of DNA and launched molecular biology. He argued that the network structure of theory groups unfolds across stages reflecting changing social relationships as group members' activities shift from generating novel science to promoting a blossoming scientific specialty. That same year, Griffith and Mullins (1972) published an article in *Science* in which they argued that theory groups were major engines of innovation across cultures, histories, and fields. When a discipline is faced with major scientific problems, small groups of scientists self-organize to create new perspectives they believe can address these issues. These groups convince themselves absolutely that they are on the path to making a revolutionary contribution to their fields. They do not exhibit the disinterestedness typically regarded as appropriate scientific practice. Rather, they actively collaborate to gain resources and promote their new perspective in the face of resistance from the scientific community. They also exhibit striking similarities in terms of leadership roles, active recruitment of younger researchers, and socio-emotional-intellectual processes, including strong internal norms of social control,

[6] To take the Phage Group as an example, the primary symbolic representation was the helical structure of DNA. Their shared model of reality was the unwavering conviction that life was grounded in an essentially physical basis. Among their shared values were "the principle of limited sloppiness," which held that some lack of precision was more likely to produce interesting experimental results, a distaste for chemistry, producing few excellent papers over many mediocre ones, and emphasizing theory over experimental data. As their leader Max Delbrück put it, "Say a little too much in the interpretation." Schrödinger's *What is life?: The Physical Aspect of the Living Cell* was the group's orienting touchstone (Cairns *et al.* 1966; Mullins 1972).

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distinctive lifestyles, mock ceremonies and awards, and in-group roles. Theory groups have a high infant mortality rate and most fail, with successful groups tending to exist between ten and fifteen years.

In 1973, Mullins published *Theories and Theory Groups in Contemporary American Sociology* (Mullins 1973).[7] He combined insights from his previous work with bibliographic data to identify the main theory groups in American sociology and develop a stage theory of theory group development. He found that theory groups form and develop through four stages. As a staunch structuralist, his theory focuses exclusively on changes in the network structure of communication among group members. Transformations in the quality of structural relations and social networks among group members (e.g., colleagueship to co-authorship) are the fundamental process of interest, *not* small group social dynamics. Shifts in the structure of the group's network are held to correlate with shifts in the intellectual content of its work.

The normal stage is the typical situation of scientific communication on a given topic: The research area is poorly integrated, intellectually and socially. Research is produced by a handful of people scattered across a few institutions. Student-teacher relations are rare and there is little concerted effort to develop the area. Co-authorship is rare; the area develops mainly through the puzzle-solving activities of "normal science." A small, informal research group forms around an intellectual leader working on routine research problems.

The shift to the network stage is precipitated by the appearance of an exciting intellectual product – a breakthrough or particularly cogent criticism of existing research. The group becomes excited about these developments. They begin interacting as trusted assessors, recruiting colleagues, and achieving agreement on key issues. Members collaborate more exclusively, ties to outsiders erode, and communication intensifies. An organizational leader emerges and helps garner resources, recruit, and establish research centers. Students are introduced and student–teacher ties are created. Members establish consensus about research style, scope, and content. The group produces a definitive programmatic statement – a guiding light and clarion call to the scientific community. Success attracts new members.

[7] Crane (1972) argued in *Invisible Colleges* that small groups develop around rapidly expanding scientific literatures. Mullins (and Kuhn) argued instead that theory groups *cause* the revolution in scientific thinking that enables the rapid growth of new literatures by producing and advocating a new theory.

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The transition to the cluster stage is qualitative. Communication becomes more incestuous. The group addresses problems set forth in its programmatic statement. Large quantities of research are generated, some of which become important scientific accomplishments. Divergences between the group's research and the parent discipline become apparent. Research in the new area becomes more tightly integrated as co-authorship strengthens theoretical connections among specific works. Rising awareness of the new perspective leads outsiders to publish critical materials about the group and its ideas. Colleagues and students gather around the core group, which becomes surrounded by a large cluster of followers.

The group's disintegration occurs during the specialty stage. The intense communication structure that for Mullins is the defining feature of a theory group breaks down as students are hired away from natal research centers, senior scientists retire or move to new positions, and because universities need to teach broadly and recruit new researchers with diverse interests. The breakup leads to efforts to institutionalize the perspective by establishing departments, research centers, professional positions, and academic societies. Routinization of their perspective occurs as textbooks, critical materials serving as counterattacks, and secondary materials are produced to maintain the purity of the original perspective. The dense, ingrown communication structure disintegrates as members return to the intermittent and loosely coupled pattern of normal scientific communication.

Fifty years later, Mullins's theory – the only theory of theory groups – remains the most important treatment of the subject. However, his exclusive focus on communication networks caused him to explicitly deny the importance of group dynamics, group cultures, emotion, individual personalities, or intellectual history for fostering collective theorizing or affecting the formation, functioning, and fate of theory groups (Mullins 1973, 31). Moreover, his failure to attend to the lived experiences of theory group members led Mullins to impute group membership to theorists without knowing if they actually identified with the theory group that he assigned to them (Camic and Gross 2004). Reflecting later, Mullins admitted that his lack of ethnographic data imposed serious limitations on his theory (Mullins 1983). Furthermore, Mullins's is a functionalist theory identifying necessary prerequisites for theory group development as a checklist of progress along a preordained trajectory. It is more descriptive than explanatory and fails to consider the specific small group processes underlying collective theorizing and theory group

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development, or that different theory groups may arrive at the same outcomes by different developmental pathways.[8] Crucially, Mullins also ignored the wider social environments in which theory groups develop their theory and compete with others over resources and the power to define what constitutes legitimate scientific thinking and practice. Though Mullins's book was popular, research on theory groups became rare once more as science studies shifted toward examining scientific specialties (e.g., Chubin 1976; Edge 1976; Shrum 1984) and laboratory practices (e.g., Garfinkel *et al.* 1981; Knorr-Cetina 1981; Latour and Woolgar 1979).

Remarkably little research on theory groups has been conducted in the interim. The most systematic data come from social network analyses informed by interaction ritual theory. Collins's (1998) magisterial *The Sociology of Philosophies* notes on page three that theory groups have been *agent provocateurs* across the entire 3,000-year history of philosophy, from the Pythagorean brotherhood to the Vienna Circle. He writes, "The history of philosophy is to a considerable extent the history of groups. Nothing abstract is meant here – nothing but groups of friends, discussion partners, close-knit circles that often have the characteristics of social movements" (Collins 1998, 3). He argues that theory groups can energize creativity among their members and that conflict between theory groups can generate new intellectual positions (Collins 1998, 526–532). He also maintains that successful intellectuals have ample "emotional energy," a vivifying force imbuing them with confidence and enthusiasm for prolonged scientific work. Emotional energy is infused into protégés via socialization, along with a sense of the creative frontiers in their discipline, such that famous philosophers tend to be students of famous mentors. However, Collins is interested in uncovering the principles that determine the structure of intellectual networks and flows of cultural capital and emotional energy across actors, not theory group dynamics, and the massive scope of his analysis combined with a lack of quality historical data means that only a handful of pages within the hefty 1,110-page tome are devoted to discussing them. Furthermore, though interaction rituals are a *group* phenomenon, Collins's approach to creativity is additive and ontologically individualistic (like Burt's 2007), centering on the idea that great creators are *individuals* able to combine *existing ideas* into new

[8] That is, that they may exhibit equifinality (see Arrow *et al.* 2000; McGrath *et al.* 2000).

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configurations by bridging structural holes amid their relentless quest to gain intellectual eminence.[9,10]

Polillo's (2020) recent analysis of the research groups responsible for the rise of financial economics, who developed their intellectual movement around new data rather than a new theory, extends these ideas. He follows Collins in arguing that repeated interactions within intellectual groups can energize collaborators, and that creativity emerges when researchers build new network ties. However, his innovative network analyses also demonstrate that authors who developed a core group of trusted collaborators received more attention, and that while ties to prestigious mentors mattered, so too did being linked to small groups of less prestigious researchers. In fact, economists with more constrained networks (i.e., those collaborating in small groups) were more creative, and bridging structural holes in the wider network had a negative effect on their creative outputs. These data clearly indicate the importance of small group dynamics for driving the creative processes undergirding the establishment of financial economics, but the network analyses are interactionally thin and the discussion of interpersonal trust within groups is quickly abandoned to instead analyze how "affect" propagates across networks. Similarly, Henriksen *et al.* (2022) blend interaction ritual theory and network analysis to examine competition between the Chicago School of Economics and the Charles River Group. They use co-citation patterns and acknowledgment sections of journal articles to create social networks for each theory group and develop proxy measures of group cohesion. Their data indicate that the Chicago School began as the underdog but that the group began cultivating cohesion in ways that led them to surpass cohesion in the Charles River Group, energizing the Chicago School and aiding the shift from Keynesian to neoliberal economics. No group dynamics beyond social cohesion are considered, and the authors make no direct connections between cohesion and collective creativity.

[9] Burt (as quoted in Erard 2004) claims, "Creativity is an import-export game. It's not a creation game." But this begs the question of where the ideas used for creative synthesis come from in the first place. The classical Durkheimian response is that new ideas, categories, and concepts initially emerge from and are supervenient on group interactions, becoming the "skeleton of thought" from which new combinations of ideas may be later generated, either individually or within groups (Durkheim 2001; Fleck 1981). Or as Sawyer (2004, 270) argues, "social groups have emergent properties that are the end result of long causal histories [so] it is essentially impossible to fully explain those properties in a methodologically individualist fashion."

[10] See Lamont (2001) and Gross (2002, 2003) for critiques of this model of the intellectual self.

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Theory Groups Reconsidered

Existing research has painted a fascinating but incomplete portrait of theory groups as social actors. We have learned much about how networks shape ideas and social relationships in intellectual fields, but we know far less about how group dynamics shape the social production of new philosophies or scientific theories. Social network analyses clearly indicate the significance of small groups for fostering creativity and motivating efforts to launch new intellectual movements, but they cannot adequately capture the significance of small group interactions or fully explain the sources of group intelligence and the emergent generation of novel scientific theories from within small groups (see Fleck 1981; Werron *et al.* 2023; Woolley *et al.* 2015). Advancing research along these lines requires reconceptualizing theory groups from a microsociological, localistic perspective that considers the importance of group dynamics and group cultures, collective identity, collective emotions, and collective ideation. Such a perspective should draw direct connections between social interactions occurring among specific people in specific locations and the social construction and transformation of scientific theories, fields, and movements. Combining rich qualitative data and a deeply contextual approach enables examining the micro-social processes driving creativity in theory groups and the social construction and contestation of ideas. This complements structural and historical approaches and supports research indicating the significance of local social interactions and group culture for enabling broader forms of social change, while advancing interaction ritual theory by illuminating the group dynamics that occur within interaction rituals (Collins 2004a; Gross 2008a; McLaughlin 2008). Doing so requires reorienting research on theory groups through three conceptual lenses: theory groups as small groups, theory groups as engines of collective action, and theory groups as faith-based collectives.

Dimension One: Theory Groups as Small Groups

Theory groups must first be understood as *small groups*.[11] Theory groups are the most disruptive of all forms of scientific collaboration, producing

[11] Some have defined small groups numerically (see Forsyth 2018; Ridgeway 1983). I instead join Fine and Hallett (2022) in using Bales's relational definition of small groups as: "any number of people engaged in interaction with each other in a single face-to-face meeting, or series of meetings, in which each member receives some impression or perception of each member distinct enough that he [sic] can, either in the time or in later questioning, give some reaction to the others as an individual person" (Bales 1950). This approach recognizes that the most crucial aspects of small

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innovative conceptual frameworks potentiating radical transformations of scientific understanding and practice. It should thus come as no surprise that they are *small* groups, as small groups are key agents of creative social change across social fields (Corte 2013; Parker and Corte 2017; Wohl 2022). Small groups exist at the meso-level of sociological analysis, creating conditions for social order by bridging self and society while providing the time, space, and resources for their members to develop distinctive idio-cultures – systems "of knowledge, belief, behaviors, and customs shared by members of an interacting group to which members can refer and that serves as the basis for future interaction" (Fine 1979, 734). They facilitate social control by socializing, monitoring, and sanctioning group members, allow contestation of dominant cultures by creating new standards that can form the grounds for mass mobilization, create spaces for developing shared symbols that become the basis for solidarity rituals, and facilitate the negotiation of inter-group status orders (Fine and Hallett 2022). In this sense they operate as a "hinge" between the micro and macro realms, providing the tensile strength on which macrostructures depend while simultaneously being constrained by them (Fine 2012, 2021).[12] Theory groups aim to transform scientific fields and birth new scientific specialties, and so it is imperative to understand them as key actors mediating change and stability across the micro and macro scientific social orders.

From a task group perspective, theory groups benefit from the effective communication, lowered interactional costs, and reduced social loafing that occur in small groups (Forsyth 2018; Ridgeway 1983; Ringelmann 1913). Small groups are more likely to develop original ideas that break sharply with existing understanding (Farrell 2003; Shenk 2015; Wu *et al.* 2019), and to develop an effective transactive memory system enabling members to share encoding, storage, and retrieval of collective information and perform in ways that are better than the sum of the individuals within them (Barnier *et al.* 2017; Wegner 1987). Classical small group studies also draw our attention to groupthink, the Abilene paradox, group polarization, and other group dynamics that can inhibit effective group theorizing and decision-making (Harvey 1974; Janis 1972; Moscovici and Zavalloni 1969), to the relationship between intergroup conflict and intragroup social solidarity (Schachter 1951; Sherif and Sherif 1953; Simmel 1964), and to the importance of internal dissent for helping groups to learn and

groups are the feeling of belonging and collective identification, and that belonging and identity are socially constructed over time.

[12] Fine (2012) specifies these as physical, temporal, spatial, institutional, and traditional constraints.

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allowing their norms to change (Dentler and Erikson 1959; Erikson 1966; Moscovici 1976).

Studies of scientific research groups are of special relevance. Theory groups are the most impactful type of research group, shifting science in new directions and catalyzing quantum forms of scientific change. Scholars within sociology and science and technology studies have spent the last five decades researching social dynamics in research groups (e.g., Hackett 2005; Leahey 2016; Pelz and Andrews 1976; Vermeulen 2009). This body of research has revealed their social structures, patterns of collaboration, the antecedents of scientific productivity and creativity, and the lived experiences of scientific work. It has also demonstrated the tensions and paradoxes that can arise within research groups and complicate their management, and identified the key roles of intimate personal relationships, collective emotions, and intersubjectivity for energizing group members, instilling commitment to its aims, and imbuing the courage to develop scientific work that cuts against the grain of established practice (Hackett *et al.* 2008; Parker 2006; Parker and Hackett 2012, 2014).

Theory groups are also a special case of the larger set of creative small groups known as "collaborative circles" – intimate friendship groups sharing goals, garnering collective resources, providing one another with emotional and creative support, engaging in extended collaboration, and negotiating and attempting to realize an innovative vision capable of guiding their work in the fields (Farrell 2003). Grounded in exacting archival research, collaborative circles theory captures the social dynamics of creative groups, including the importance of specific kinds of interpersonal relationships and social roles for cultivating deviant forms of collective creativity. Like a teenage gang providing solidarity and goading each other into ever more risky and deviant endeavors, collaborative circle members support and goad one another to cross the borders of accepted ways of thinking in a field and voyage far beyond them to the mysterious shores of creative *terra incognita*. Friendship dynamics fostered through persistent interaction lead to the development of a new creative vision for their work and collective attempts to win its acceptance within their creative community. Collaborative circles are not of a single type; a family of sibling circles operate across cultural fields and vary in their social structures and group dynamics (Parker and Corte 2017). This book adds new data and fresh concepts to collaborative circles theory and helps to uncover what is distinctive about collaborative circles in the sciences, aiding efforts to understand how collaborative circles are shaped by their fields (e.g., McLaughlin 2008; Stamm *et al.* 2019).

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Dimension Two: Theory Groups as Engines of Collective Action

Theory groups must also be understood as *engines of collective action*. Theory groups work to alter the structure of their scientific field and reorient it around their program for scientific change. They are instigators of scientific and intellectual social movements (or "SIMs") – "collective efforts to pursue research programs or projects for thought in the face of resistance from others in the scientific community" (Frickel and Gross 2005, 206). Theory groups are analogous to "critical communities" in civic social movements (Rochon 1998): small, self-aware, mutually interacting groups of thinkers who have identified issues with the current situation in their disciplines and devised a new perspective and research program that they believe offers a better or more complete understanding of work in their fields. In doing so they establish the challenge and define the intellectual space in which the new SIM will operate by airing objections and crafting programmatic statements about their new form of scientific practice. In short, they frame and conceptualize problems with the existing state of play in their discipline and craft a unified discourse and new scientific theory that lends intellectual impetus to a nascent scientific movement.

However, developing the new theory while framing it in terms of problems with the current state of the field is only part of the work conducted by theory groups. The main tenet of SIM theory is that all science and all scientific ideas are political, and that good ideas are necessary but insufficient explanations for the success or failure of new intellectual positions. Knowledge advances *because* of intellectual politics, not despite it. Scientific dominance results from the combination of a set of potentially fruitful ideas and a set of advocates who engage in focused collective action to promote the new theory as a means of overcoming existing problems. Theory group members must thus build networks, research organizations, and strategic alliances to compete with orthodox practitioners and other upstart groups, networks, and organizations. They develop new communication channels – journals, conferences, workshops, blogs – to popularize and promote their perspective. They engage in "articulation work" (Fujimura 1987) to shape funding initiatives and programs within government agencies in ways that align with their perspective and research goals and they may attempt to connect the group's work to practical issues that can enhance its legitimacy and open its funding structure. They also work to institutionalize the movement by creating new positions and departments to train new generations of student protégés that will carry the light forward.

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Scientific and intellectual social movement theory and research have focused primarily on institutions and networks (Frickel and Moore 2006). Research considering the micro factors that sustain or detract from scientific movements has lagged, and we are missing a more localistic political sociology of science and knowledge (Camic and Gross 2004; Camic *et al.* 2011). An important starting point for developing this understanding is recognizing that small groups are often the precipitating nuclei of social movements and political action (Hirsch 1986; Olson 1965; Summers-Effler 2010), and that conflict between such groups affects the successes and failures of the movements that they seek to advance. So it is with theory groups, which do not exist in ether, but instead occupy fields of cultural production wherein groups, networks, and organizations vie for resources, legitimacy, and a finite amount of attention space within journals, conferences, and academic departments (Bourdieu 1988; Collins 1998; Polillo 2020). Such conflict involves emotionally intense face-to-face encounters as theory group members spar with their competitors in conference sessions, funding panels, and public debates wherein they engage in various forms of dramaturgically enacted boundary work to support particular ways of understanding fields and what constitutes good scientific work. A multilevel understanding of SIM dynamics requires close examination of such encounters and their effects on groups, movements, and fields.

Theory groups that manage to shift research within their fields must then wrestle with a new set of challenges that come with success, and which have hardly been touched upon within the literature. These can include losing personal control over the group's theory as others use it for different purposes, faddishness and oversimplification of their new perspective, taking on increasingly powerful opponents as the group moves into larger scientific arenas, trying to remain innovative as the group becomes the standard bearer of a new orthodoxy and subject to attacks by new upstarts, transformation of the original group culture as the popularity of its ideas expands the social network around it, never-ceasing requirements to garner funding to support the group, the desire to socialize a new generation who can continue advancing the group's perspective, and the exhaustion and overwork that comes with burning so brightly for so long. Studying theory groups can thus also advance understanding of knowledge production and ideology formation in civic social movements and their transmission via collective action (see Oliver and Johnston 2006; Schurman and Munro 2006), and of conflict dynamics among social movement groups and the challenges and paradoxes that arise once a group has achieved success and gained wide recognition.

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Dimension Three: Theory Groups as Faith-Based Collectives

Finally, theory groups must be understood as *faith-based collectives*. Popular conceptions of science juxtaposing it with religion because one is ostensibly objective, while the other bases its beliefs on faith, are misguided. Faith plays an instrumental role in science, and nowhere does it play a larger role than within theory groups.[13] Recognizing the critical importance of faith in theory groups is not a criticism, but an admission of a simple sociological reality. We must move beyond idealized and moralistic notions of scientific skepticism and disinterestedness if we are to understand the core social processes that enable a group to produce transformative scientific theories. I contend that theory groups are sociologically akin to religious sects, and that knowledge production and social interaction within them are subject to many of the same general processes (Niebuhr 2016; Stark and Finke 2000; Weber 1978). Theory groups are "greedy institutions" in ways that are directly analogous to the religious sphere, making total claims on group members and attempting to encompass the entirety of their identities within the group's ambit. They "seek exclusive and undivided loyalty and they attempt to reduce the claims of competing roles and status positions on those they wish to encompass in their boundaries. Their demands on the person are omnivorous" (Coser 1974, 4; Cox 2016; Puddephatt 2008).[14,15] These all-encompassing

[13] Religion is the obvious antagonist of science, today as it was during the Enlightenment. However, all social institutions involve "a sacred area that is resistant to profane examination in terms of scientific examination and logic" (Merton 1949, 265). Thus, these considerations are not limited to conflicts between science and religion. For instance, the norm of organized skepticism is itself "sacred" to science and in an important sense an untestable article of faith. Scientists exhibit strong emotional reactions when the principle of organized skepticism is leveled reflexively at the assumption that organized skepticism is good in and of itself. The sacred is hardly limited to religion.

[14] Coser's analysis focuses mostly on religious sects but extends to secular institutions like families, political groups, and military organizations. Greedy institutions employ specific social psychological practices that encourage loyalty and limit individual agency: 1. sanctions of group members to limit their interactions with other social spheres; 2. immersion of group members within a symbolic status structure; 3. promoting feelings of exclusiveness or elite status; 4. trials of worthiness to monitor and reward conformity and punish or eject weak or antagonistic members that threaten group cohesion; 5. "framing" – greedy institutions promote definitions of reality that operate on the microinteractional level to maintain devotion and commitment to the group and its purposes (see Cox 2016; Puddephatt 2008).

[15] Coser (1975) also wrote about "scientific sects" in his scathing American Sociological Association presidential address entitled, "Two Methods in Search of Substance." He defined a sect as "a group that has separated in protest from a larger body and emphasizes an esoteric and 'pure' doctrine that is said to have been abandoned or ignored by the wider body. Sects are typically closed systems, usually led by charismatic leaders and their immediate followers. They attempt to reduce communication with the outside world to a minimum while engaging in highly intense

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demands and undivided devotion necessitate generating a high degree of faith in and identification with the group, its members, and their purpose, and the level of involvement and devotion demanded by them inhibits members' willingness and capacity to participate in other areas of social life. Theory groups are "charismatic groups" characterized by a faith-based belief system, high levels of social solidarity, unbending behavioral norms, and imputation of charismatic power to group leaders, while repeated meetings and the enactment of collective rituals nurture and amplify faith and cohesion (Galanter 1989, 2013).[16]

Once formed, theory groups produce revolutionary science, enacting the strongest forms of scientific deviance outside of outright research misconduct. Moreover, group members must bear the huge investments of time, energy, and resources involved in developing a new scientific theory and accept the substantial professional risks involved in having the new theory criticized, ignored, or being considered a pseudoscientist by one's peers. All these costs and risks are borne in pursuing a yet unverified theory for explaining the social or natural world. Theory groups must thus totally convince themselves of the correctness of their new framework and be absolutely committed to its realization based on untested ideas and scant empirical evidence. Group members must be *impassioned*, *zealous*, and *totally dedicated* to the group and believe wholeheartedly in its scientific vision. This requires social cultivation of deep and abiding faith in the group and its ideas, particularly in the early, grasping stages as it conceptualizes its nascent theory. This faith is obvious even to outside observers, who often criticize theory groups for what they view as slavish and sectarian devotion to their theory.[17]

It is axiomatic within the sociology of religion that faith is socially produced and reinforced through repeated participation in emotionally intense forms of group interaction (Durkheim 2001; Stark and Finke 2000; Wollschleger 2012). From this perspective, the intense social

interactions between the True Believers." In this speech, Coser viciously attacked the ethnomethodologists and those committed to complex statistical methods as sects devoted to methodological fetishism rather than substantive advancement of sociological understanding.

[16] Galanter adopted the term "charismatic groups" to indicate that cohesive groups do not occur solely within the religious sphere; rather, they operate within and actively seek to transform diverse areas of social life. Galanter approaches the subject from a psychological perspective that resonates with Durkheimian perspectives on social solidarity and Weberian perspectives on charismatic leadership.

[17] For example, the theory group that launched molecular biology was known as the "Phage Church" and their leader Max Delbrück was called "the pope" by other group members (Stahl 2001). The Skinnerians at Columbia were critiqued as a cult (Wendt 1949), and Nadasdy (2007) has referred to "the gospel of resilience."

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solidarity and unwavering faith characteristic of theory groups result from their use of interaction rituals in which members develop a mutual focus of attention and become entrained in each other's bodily rhythms and emotions (Collins 2004b; Draper 2019). Successful interaction rituals share common features, including: 1. a group of people assembled in the same location; 2. barriers to outsiders that maximize the sense of the group as a separate entity; 3. a mutual focus of attention on a common object or activity; 4. a shared emotional experience facilitated by rhythmic entrainment and common mutual focus. Interaction rituals produce group solidarity and cause group members to identify with the theory group, energizing them to work on its behalf. Successful theory groups are thus those with high "ritual proficiency" (Draper 2019), consistently able to draw on social practices and tactics that lead to high levels of effervescence and solidarity. By the same token, alterations in conditions enabling ritual proficiency can help to explain the ebb and flow of faith, group cohesion, collective action, and conflict across a group's life course.

Key ideational dynamics also occur within interaction rituals. The intense mutual focus afforded by successful interaction rituals, combined with solidarity experienced within the collective, enables group members to cocreate new frameworks of thought and collective representations in the form of scientific concepts and symbolic representations of the theory. These allow for shared meaning and become the theory group's sacred symbols – totems charged with emotional significance that represent the group and which must be defended against desecrators (Durkheim 2001; Fleck 1981, 1986). Concepts and symbols become loaded with emotional significance, reinforcing feelings of membership and energizing action on behalf of the group, even when alone. Crucially, this faith is not just constitutive of emotional commitment to the group but of a fundamental belief in the objective truth of its theory.[18] Its ideas become, "... sacred objects in the strongest sense; they inhabit the same realm, make the same claims to ultimate reality as religion. 'Truth' is the sacred object of the scholarly community ... As Bloor (1976) has pointed out about mathematics, intellectual truth has all the characteristics Durkheim stated for the sacred objects of religion: transcending individuals, objective, constraining, demanding respect" (Collins 1998, 19). Or as Draper (2019, 138) notes, "Any allegiance to a particular belief depends entirely on an experience of emotional force emanating from shared practices. Beyond

[18] And faith can be unfounded, as with "N-Rays" or the Pons and Fleischmann cold fusion affair (Huizenga 1993; Wood 1904).

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this, the higher levels of certainty of confidence in the belief depend on the intensity and frequency of one's participation in successful interaction rituals that treat the belief as sacred." Maintaining faith while enabling the immersive forms of intersubjectivity that allow for the abstraction and conceptualization involved in group theorizing requires that the group continues to gather and successfully enact these interaction rituals.

A New Approach and New Questions

The conceptual and analytic approaches used in this book break sharply with past research. Theory groups are conceptualized as socio-emotional collectives exhibiting emergent processes that cannot be accounted for structurally. To this end, each chapter considers theory groups as small groups, as engines of collective action, and as faith-based collectives. Theory groups are several things simultaneously, and this strategy reveals these different facets. My analytic approach is microsociological, focused on high-resolution analyses of social interactions among a group of closely collaborating scientists. My empirical approach is ethnographic, and I combine many forms of qualitative data to analyze the group processes driving the social construction, contestation, and transformation of a scientific theory. This is the first analysis of a theory group by a sociologist who spent hundreds of hours observing the group, interviewing its members, and witnessing the reception of its ideas by the scientific community. It is grounded in data of unprecedented volume, granularity, and proximity to the group's creative activities, as I have followed classical work in laboratory studies in getting as close as possible to the point of scientific action (e.g., Knorr-Cetina 1999; Latour and Woolgar 1979; Traweek 1992). It is also a longitudinal investigation spanning fifteen years (2002–2017). It thus joins a small set of studies in the sociology of science that have maintained the same research focus for over a decade (e.g., Collins 2019; Hermanowicz 2012; Vertesi 2020).

The "new sociology of ideas" and the recent turn among microsociologists toward situational analysis have also inspired my research approach. For more than twenty years, Charles Camic and colleagues have argued for a localistic sociology of knowledge capable of analyzing the micro-social contexts in which ideas are produced, evaluated, and contested (Camic 2020; Camic *et al.* 2011; Gross 2008b). They contend that we must look beyond macrostructural factors to understand how biography, identity, geography, and research practices matter for the fates of ideas and their creators. We must also look at the subjective meaning that ideas have for

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those who produce them rather than assuming that they are transparent to the observing sociologist because "... meanings are always embedded in socio-intellectual contexts which must be opened up to in-depth investigation before the ideas themselves can be understood" (Camic and Gross 2004, 245). Outmoded distinctions between "internal" and "external" factors in scientific development should be supplanted by the understanding that scientific ideas are shaped by the totality of the experiences and lives of those who create them. This requires reconstructing the social contexts in which ideas are produced, evaluated, and contested to describe the social worlds in which these ideas make sense (or do not). This perspective dovetails neatly with the shift in microsociology toward situational analysis (e.g., Collins 2008; Nassauer 2019).[19] Much of the analysis in this book is "situation-centric" (Klemsdal and Clegg 2022), bracketing macro factors to examine how interactions in local social contexts affect collective ideation and the transmission, rejection, or acceptance of new scientific ideas.

My conceptual approach also aligns with a steadily growing body of research that conceptualizes interaction rituals as occurring within the long-term flow of group interactions. Such work has used interaction ritual theory to explain behavior in social settings ranging from rap ciphers and big wave surfing to political protests, sports fandom, and churches (e.g., Corte 2022; Cottingham 2012, 2022; Draper 2019; Lee 2016; Summers-Effler 2010; Wellman *et al.* 2014, 2021). This represents a significant shift from conceptualizing interaction rituals as a series of situations through which individuals travel with little connective tissue among them to one in which shared history and meaning, embodied in group symbols and stories, are critical (Barbalet 2006; Fine 2005). As Corte (2022) argues:

> The success of a ritual depends not only on the situation – and the vestiges of other situations – for each participant (Collins's main focus), but on what comes before (the broader history of the group) and what comes after (how the event is talked about, and perhaps how it is enacted).

This book contributes to this perspective by using aspects of interaction ritual theory, viewed through a group dynamics lens, to analyze social

[19] Situational analysis has its deepest roots in pragmatism, and situations can be defined as, "holistic contexts of actions where the actors never experience or relate to isolated singular objects or events, but where an object or event is always experienced in their relationship to, as an aspect or phase of, an environing experienced world – a situation" (Dewey 1938, as cited in Klemsdal *et al.* 2022). From this perspective, "Microsituational encounters are the ground zero of all social action and sociological evidence. Nothing has reality unless it is manifested in a situation somewhere" (Collins 2000, 18).

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interactions within theory groups. Doing so helps to explain the distribution of group creativity over time and space, the social production and erosion of scientific faith, why some rituals succeed and why others fail, and patterns of intellectual conflict in academic conferences and scholarly debates.

I have also used my unique access to RA to capture aspects of theory group dynamics that have been impossible to capture previously. I have foregrounded the importance of specific geographic locations through a multi-sited ethnography, considering the importance of places such as remote islands for facilitating group creativity and conference centers as evaluation sites offering critics a place to challenge the group's new theory. I have attended to connections between emotion, cognition, and the production, acceptance, or rejection of scientific ideas. My analysis describes situations of solidarity, flow, and intimacy that inspire, and heated debates that sometimes lead to theoretical refinement and at other times to resentment or internal schisms that hamstring collaboration. The "turn to practice" highlighted in the above perspectives attuned me to the characteristic "modes of working and doing" (Amsterdamska 2008, 206; Heilbron 2012; Shove *et al.* 2012) that RA leaders used to catalyze collective creativity within the group. Lastly, every chapter touches on the issue of what happens when groups and fields collide. Theory groups aim to transform science, and so they provide the opportunity to consider how local forms of interaction spill over to affect social life across broader swathes of time and space, and how local interaction is structured by outside groups, institutions, and communities (Collins 1981; Fine 2021; Turner 2005).

Plan of the Book

My research approach has led me to seek answers to six fundamental questions about theory groups, scientific creativity, and intellectual change. The first question focuses mainly on internal group dynamics; the rest focus on the mutually constitutive effects of interactions between a theory group and the scientific community.

1. What types of socio-emotional practices and small group dynamics enable a theory group to produce its scientific theory, and how is the group production of creativity distributed across time and space?
2. How does the increasing size and diversity brought about by success affect a theory group's idioculture and creative capacity?

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3. How do second-generation theory group members relate to the original members, and what role do they play in collective theorizing and within the scientific social movement the group aims to promote?
4. How does intellectual conflict between theory group members and outside critics in public settings affect the group, its ideas, and the ideas of their critics?
5. What social forces cause the group to lose control over its ideas, and with what consequences for its reputation and ability to continue developing its theory?
6. Why do theory groups disband?

Chapter 2 describes RA, resilience theory, and the data and methods on which this investigation is based. It begins by describing the discovery of resilience as recounted to me by C. S. "Buzz" Holling, RA's charismatic intellectual leader and one of the most influential ecologists of the last century. I then describe Holling's early collaborations in which he developed and tested his own theory of group interaction and refined a set of socio-emotional practices for fostering creative group work that he would continue to use in RA. I describe RA's evolution from its infancy as the Resilience Network (RN) through its transformation into one of the most influential theory groups in sustainability science. I relate key aspects of resilience theory and describe RA's intellectual contributions and the immense influence of their ideas to show their predominance in sustainability science and indicate how their theory and creative vision differed from what preceded it. I close by outlining the methods used in this investigation, the five longitudinal datasets on which this book is based, and my own relationship with the group.

Chapter 3 examines the role of collective emotions and affective small group dynamics for facilitating group theorizing, propelling deviant forms of scientific thought, and encouraging the rise of new scientific social movements. It describes RA's idioculture, their context of theoretical discovery, and the socio-emotional practices that Holling used to catalyze transformative scientific creativity – a process that they called "island time." I show how holding short, energetic meetings on remote islands at far-flung locations around the world that included the performance of group rituals, personality selectivity, social bonding, charismatic leadership, and inductions into secret scientific societies produced what I call "hot spots and hot moments." These are brief but intense bursts of collective emotion, group creativity, and exceptional scientific performance where transformative science gets produced and faith in the group and its

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ideas is socially generated. Doing so highlights previously unknown aspects of theory group dynamics, including the bursty nature of creative production within them, and the role of collective emotional states, relationships, and evocative locations for producing influential forms of scientific knowledge capable of supporting new scientific movements.

Chapter 4 shows how, paradoxically, RA's successes led to the gradual loss of its generative idioculture and collaborative processes. This is the challenge of "getting big while remaining small." Emotions and social bonding enabled the group's initial successes but RA's contact with and influence on sustainability science created pressure, internally and externally, to grow and diversify the group. This caused the gradual erosion of the idioculture and social practices that characterized RA's early phases. Irreverence and informality were replaced by increasingly bureaucratic processes. Rituals that once generated solidarity and commitment began to ring hollow or cause cleavages that led to factions and the loss of faith. Key roles and relationships were lost as original members dropped out, and the group faced challenges similar to those of routinizing charismatic authority in religious movements.

Chapter 5 considers how inter-generational dynamics affected sociality and knowledge production in RA. The Resilience Alliance Young Scholars (or "RAYS") were recruited by RA to help test and refine resilience theory but were brought into the group after the founding generation had established its main tenets. Furthermore, RA and resilience theory were starting to be subject to criticisms from outside as their ideas absorbed increasingly more attention space in sustainability science. I argue that the distance of the RAYS from the high-intensity ritual interactions of early days, combined with their awareness of mounting skepticism from outside RA, led them to be less emotionally wed to the theory and more skeptical about it. Data from interviews, articles, books, and observations of a two-day mock court in which the RAYS literally put the ideas of the first generation on trial show that they played a crucial role in testing and refining resilience theory, identifying key theoretical scoping conditions, and crafting some of the first metrics and measurements of core RA concepts. In all of this the RAYS contributed in ways that went far beyond the "normal science" expected of second-generation theory group members.

Chapter 6 examines the politics of scientific fields at the level of microsocial interaction by analyzing intellectual conflict between RA members and their detractors in sustainability science. Data come from firsthand observations of acrimonious interactions between RA members and critical

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outsiders during academic conferences, and from fine-grained analyses of public debates, online forums, and scholarly publications. I identify the major groups in sustainability science with whom RA came into dispute and provide blow-by-blow accounts of key episodes of intellectual conflict between RA members and outside researchers. I show how RA used its conferences as venues for proclaiming their theoretical faith, converting new members into their movement, and challenging disciplinary boundaries in sustainability science. Researchers from competitor groups enacted carefully curated public performances (or "anti-rituals") designed to reestablish borders in their field by challenging RA members' scientific faith, publicly shaming them, and desecrating their most sacred scientific symbols. I close by showing how conflict over attention space and over understanding of what constitutes legitimate research altered RA's ideas and those of its detractors. In this way, the friction from clashing perspectives resulted in second-order synthesis that led to substantive changes and creative advances for RA and its competitors.

Chapter 7 examines the process of "theoretical drift." Science is based on a gift economy in which researchers give their products freely to the scientific community in the collective pursuit of knowledge, but this necessitates yielding control to those who may use our ideas in ways that differ from our intentions and harm our reputations. This chapter describes five sociological processes that led to theoretical drift and to RA coming under fire for alternative interpretations of its theory. These include rampant faddishness, the abstraction and elaboration of individual concepts from the theory, the relativity of the creative frontier, the sheer welter of new research, and conceptual travel and stretching. The chapter closes by discussing RA members' attempts to regain control over their theoretical narrative through public performances and by publishing articles and books designed to reestablish the purity of their original theoretical vision.

Chapters 8 and 9 recount group interactions occurring across the final three island times, leading to RA's purposeful destruction and reorganization. Whereas previous chapters excerpt quotes and episodes of interaction to illustrate my arguments, these chapters use a first-person, present tense narrative to depict management issues arising during the final island times as RA attempted to manage the shift from a small group of friends to an organization with formalized roles and regulations while maintaining the same relationships that existed in its earlier phases. I describe RA members' struggle to continue collaborating as the conditions for effective cooperation and group decision-making were being undermined by the same

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social forces they were attempting to manage. My own role in RA also comes to the foreground in these chapters when during pivotal moments of interaction group leaders asked me to provide guidance based on my research, which consequently shaped their decisions and RA's future.

Chapter 10 summarizes my findings and discusses them in relation to relevant theory and research. It offers a new model of creative decay that identifies the friction resulting from interactions between a theory group and the fields that it attempts to influence as a crucial cause of theory group disintegration. The book closes by distilling nine principles for managing scientific collaborations derived from the RA case that are useful for researchers, universities, and science funding agencies wishing to support creative research groups and encourage transformative science.

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