



Enhancing urban resilience knowledge systems through experiential pluralism

Zbigniew J. Grabowski^{a,b,*}, P. Zion Klos^c, Chad Monfreda^d

^a Cary Institute of Ecosystem Studies, 2801 Sharon Turnpike, Millbrook, NY, 12545, United States

^b Urban Systems Lab, The New School, 79 Fifth Ave, 16th Floor, New York, NY, 10003, United States

^c Department of Environmental Science and Policy, Marist College, Poughkeepsie, NY, 12601, United States

^d Princeton Mellon Initiative, Princeton University, Princeton, NJ, 08544, United States

ARTICLE INFO

Keywords:

Urban resilience
Knowledge systems
Alienation
Epistemological pluralism
Experiential pluralism
Climate change

ABSTRACT

Urban resilience to climate change scholarship has increasingly focused on increasing its salience for existing decision making processes. At the same time, large inequalities in vulnerability to climate change mirror inequalities in the social power of different urban residents. Existing approaches have improved epistemological pluralism and reflexivity in knowledge systems research, yet remain hotly contested by urban communities. Conceptual gaps have become evident on how knowledge systems research addresses highly unequal forms of decision-making largely responsible for the problems that resilience research now paradoxically seeks to address. Because of these dynamics, knowledge systems research continues to grapple with the fundamental and politically charged question of what constitutes ‘knowledge,’ in urban systems. Drawing upon our own experiences as resilience researchers and a select review of literature on the philosophy and politics of knowledge production, we offer the concept of ‘experiential pluralism,’ defined as the acknowledgement of the inherent validity of individual and collective experiences in framing knowledge needs despite their seeming contradictions, to explore how knowledge systems may address issues of social alienation prevalent in cities. We offer concrete examples of how such a shift makes ethics explicit in research, places greater emphasis on relationship building, and place based creativity in addressing urban climate resilience challenges. In closing, we discuss the role of addressing alienation through experiential pluralism in order to create more democratic modes of urban governance.

1. Conflicted histories of urban knowledge systems

In an era of rapid environmental, social, and infrastructural change, cities are test beds for research methods seeking to transform social, environmental, and technological systems (Gieryn, 2006). The interlocking threats of anthropogenic climate change, extreme weather events, induced rapid sea level rise, and their systemic consequences, make clear that technological infrastructures and the consumption they support have emerged as dominant threats to sustainability, and yet have highly unequal consequences for urban residents (e.g. Bennett et al., 2016; Anguelovski et al., 2016). Within this context, cities have mobilized knowledge systems to advance urban climate resilience and sustainability (Muñoz-Erickson et al., 2017). There is little evidence, however, that knowledge systems research adequately addresses the various forms of social alienation undermining trust in democratic institutions (Stoker, 2016), and in the social value of resilience research (Kaika, 2017).

Here we argue that knowledge systems science can better advance urban sustainability by going beyond narrow definitions of knowledge and decision making to include the diversity of experiential knowledge emerging from long standing struggles to survive in the city. Simply put, we call for a praxis that identifies, empathizes, and incorporates experiential knowledge to collaboratively envision and enable new forms of daily life.

2. From resilience to transformation: what role does knowledge play?

Fortunately, knowledge systems research already recognizes the need to reference and integrate knowledge from a wide variety of disciplinary practices, government agencies, and private sector entities (Miller et al., 2008). Such knowledge pluralism increases the salience of analyses and models in existing decision-making arenas (Ernstson et al., 2010; Fink, 2011; Muñoz-Erickson et al., 2017), representing an

* Corresponding author at: Cary Institute of Ecosystem Studies, 2801 Sharon Turnpike, Millbrook, NY, 12545, United States.

E-mail address: grabowskiz@caryinstitute.org (Z.J. Grabowski).

evolution of the ‘loading dock’ and ‘information deficit’ models of science (Callon, 1995; Cook and Overpeck, 2018). However, uncritical adoptions of the language of ‘co-production,’ calling for closer collaborations between ‘decision-makers’ and researchers (e.g. Weichselgartner and Kasperson, 2010), may further centralize knowledge production and utilization in unequal ways (Scott, 1998). These fears appear justified by the present emphasis in resilience and sustainability research on strengthening relationships between research institutions, existing government agencies, and powerful private sector actors (Campbell, 1996; Escobar, 1998; Lawhon and Murphy, 2012; Martin et al., 2018). These recent trends continue a long history of urban research using scientific expertise in non-democratic and highly problematic ways of thinking about and managing cities (Scott, 1998; Light, 2009; Kingsland, 2005; Lachmund, 2013). Expert efforts to ‘improve’ cities have instead exacerbated the racialized real estate market segmentation and uneven development that plague US cities to this day (Smith 1978, Rothstein, 2017; Massey and Tannen, 2018), standing in stark contrast to universal narratives of urban progress. These long standing inequalities in political power, wealth, socio-economic conditions, and their relationship with racial and ethnic identities fundamentally shape urban trajectories, urban form, and vulnerability (Brenner, 2009; Purcell, 2013, Steele et al., 2012).

As community level rejections of resilience and green infrastructure in various US cities (e.g. Monteverdi, 2017; Kaika, 2017) make clear, we must pay attention to opposition to what has become construed as the ‘resilience agenda.’ Such ‘dissensus’ indicates the problematic persistence of inequity and exclusion in urban decision-making and knowledge production, and underlies calls for ‘just transitions’ (Newell and Mulvaney, 2013). Attending to ‘dissensus,’ or disagreements over the framing urban resilience and sustainability is a viable research method for uncovering how cities continue to be transformed and by whom (Kaika, 2017), setting the stage for negotiations over what constitutes relevant knowledge. To correct this imbalance, knowledge systems scholars must reverse the social alienation that results when (relatively) privileged researchers promote highly-specialized, disciplinary ways of knowing the city over the lived knowledge of its residents.

3. From working on to working with: engaging experiences of urban residents

He we argue for the need to address social alienation and improve knowledge systems by engaging a more robust and representative set of experiences in the process of producing knowledge, which we call experiential pluralism. Experiential pluralism assumes that all human and non-human experiences are equally valid—in the sense that each experience is equally ‘real’ and every experience is itself an act of knowing—regardless of their subjective evaluation by others. Experiential pluralism forms the basis for epistemological pluralism but goes further to acknowledge that the ways we contextualize past and present experience mediate what knowledge we consider valid and useful. It also grounds knowledge systems in affinity scholarship (Mason, 2018), which treats often contradictory imaged futures as forms of experiential knowledge. Affinity and imagination are particularly relevant to resilience research because they co-produce emotion, knowledge, and meaning making in times of loss and change (Marris, 2014).

This essay thus serves as a provocation to urban resilience scholars. We think that the relatively privileged social position of urban researchers makes us well suited to address deep issues of equity and alienation *should we so choose*. Such choice begets great responsibility; while research is not immune to its own internal political struggles, our relative privilege facilitates interactions within powerful institutions and marginalized social settings. Our effectiveness within and across these domains determines the accuracy and representativeness of our research (our groundedness), and its relevance to different social actors (our situatedness). Here we present issues encountered in our own research experiences in climate adaptation and mitigation programs, and

elaborate the conceptual and pragmatic basis for appreciating experiential pluralism as a method for addressing social alienation. While not exhaustive, the following discussion explores four types of alienation often encountered in urban research and two example strategies for resilience researchers to develop a more empathetic and effective praxis.

4. Alienation as an obstacle to equitable urban transformation

We define alienation as the disjuncture between an individuals’ sense of self and their identity as constructed by the dominant society (modified from Purcell, 2013). This definition expands upon Marx’s, (1961) original definition of alienation—the estrangement of a laborer from the means and fruits of their labor—to include how socially contextualized individuals make ‘sense’ of their emotional, intellectual, and physical states (Marris, 2014), and the effects of such sense making on behavior and cognition (Seeman, 1959; Schacht, 2015). Seeman (1959) identified five distinct but complementary forms of alienation: powerlessness, meaninglessness, social isolation, normlessness, and self-estrangement. While distinct, each refers to the experience of a self separated from the larger society—a separation that cannot be healed by personal action alone. Such alienation can only be mended by either a change in the dominant values of the society or acceptance by a sub-culture with its own set of norms and values (Becker, 1967).

Alienation provides a productive lens for resilience research by demanding new methods for engaging the creative human capacities required for the just and effective cultural, cognitive, and psychological transitions we seek. Knowledge systems that fail to address alienation inevitably misrepresent the conditions of the city as experienced by urban residents. Such epistemologically inaccuracy engenders poorly framed, ineffective, and potentially pathological interventions, risking public opposition and mistrust, and undermining future success. Below we examine how resilience research can alienate urban communities and residents, who often are the targets for resilience interventions. Each section identifies alienation in one of four domains: expertise; socio-economics/class; racial-ethnic/cultural identity; and norms around sensory capacity and physical dis/ability.

4.1. Experts as aliens and alienating experts

The alienation of expertise is two-fold. First, intellectuals are often seen as alienated in their non-adherence to dominant social values and customs (Seeman, 1959), and isolation from the broader social milieu because of their privileged social position, often manifest as distrust and jealousy among the broader public (Bäckstrand, 2003; Lesen, 2016). Second, experts themselves can alienate individuals and communities by failing to recognize their experiences as valid forms of knowledge, perpetuating the technocratic management of society divorced from the lives and living conditions of everyday people (Wynne, 1992; Scott, 1998; Jasanoff et al., 2004; Kaika, 2017).

An a-priori boundary between ‘experts’ and the ‘public,’ however, emphasizes the formal training and institutional position of experts, while failing to understand the more fundamental process by which human experience generates useful knowledge. Such an understanding must confront a culturally entrenched Newtonian worldview that says we are separate beings whose subjective experience is not really real, living in a dead, insentient world. This paradigm, grounded in a naive and outdated scientific reductive materialism, legitimizes much of our public knowledge and discourse. It is a view that not only privileges the physical sciences but also urges the social sciences to be similarly hard, quantitative, and objective. Yet, the view goes largely unchallenged, despite its tenuous philosophical and empirical justification (Whitehead, 1925) and reliance on an indefensible conception of singular ‘rationality’ (James, 1879). Modern philosophers of science such as Nancy Cartwright (1999) have also identified the impossibility of creating a unified science out of different disciplinary practices

possessing incompatible and often hidden core assumptions. Cognition research likewise challenges the idea of a singular reality, finding that shared cognitive exercises produce shared experiences of a given event, through cognitive pathways deeply conditioned by upbringing, training, and life experience (Hardin and Conley, 2001). These parallel conclusions of philosophers and cognitive scientists and debunk the supremacy of empirical science as de facto authoritative source of social knowledge (Feyerabend, 1993).

These observations underlie calls for epistemological equity in interdisciplinary science (Miller et al., 2008) and coincide with social scientists increasingly questioning how uncritical adoption of the ontological and epistemological assumptions of the Newtonian paradigm conditions their work. In a rigorous and provocative book, titled *Quantum Mind and Social Theory*, international relations theorist Alexander Wendt (2015) makes the case that a radical shift in perspective is overdue and likely to open new possibilities for how the social sciences understand and engage the world. This bold, new questioning includes climate change adaptation scholars like Karen O'Brien (2018), (2016); also see Fazey et al., (2018), who, following Wendt, asks us to be open to the possibility that our most deeply held beliefs about the workings of the world are wrong, and that a paradigm shift may offer a route to “conscious and intentional transformations to sustainability.” As a final consideration, as such transformations require deep material interventions, we must avoid the privileging of abstract and generalizable intellectual labor over embodied and contextual labor required to actually build the world (Sohn-Rethel, 1978), a form of labor discrimination often falling along socio-economic class boundaries.

4.2. Class discipline, social status, and economic alienation

Economic alienation refers to Marx's, (1961) classical definition of alienation as the purposeful separation of the exchange value of labor from its wages to abstract a profit, and the distributed social processes that tie social position to economic status. Socio-economic alienation thus stems from privileging the economic dimension of social life; all other aspects of social value become reduced to economic metrics. Urban transformation projects perpetuate such alienation through practices that reduce the uneven, contextual, and experiential ways people value urban space to metrics such as property values, green space indices, levels of education, and income, etc..... Knowledge systems that reduce human experience to simplified metrics in order to make populations ‘knowable’ pose a fundamental conceptual and political problem (Scott, 1998). Most troublingly for urban research is the uncritical acceptance of the financial calculus of real estate valuation and risk categorization in defining and mapping urban space, a logic long utilized to fuel racist and uneven real estate development and infrastructure financing (Smith, 2008; Rothstein, 2017; Gould and Lewis, 2012). Even cities explicitly embracing social equity goals, such as Portland, OR, have not escaped this logic. The now globally exported Portland EcoDistricts development strategy utilizes ‘investment attraction’ language to market new developments as sustainable due to a combination of energy efficiency, green infrastructure, and amenity features in walkable zones (Bennett, 2010). Such a framework commodifies space in two ways. First, a focus on ‘real estate’ and traded in local, national, and international financial markets purposefully commodifies land (Smith, 2008). Secondly, these ‘renewed’ environments are aggressively and explicitly marketed towards new classes of urban professionals, often in racist ways and through new digital platforms (Davidson and Lees, 2010; White, 2017). In response, a number of community based organizations have pursued their own visions of sustainability and quality of life in Portland, which over the last decade has included discussion of the relationship between current housing prices, historical marginalization, opportunities for meaningful employment, and racist policies and city planning (Lubitow and Miller, 2013; Gibson, 2007).

More fundamentally, economically flattened space alienates

individuals from the contextual ways their identities are woven through an urban fabric that supports social life (Bourdieu, 1998). Resilience scholarship cannot escape the contestation and negotiation of more deeply held values and aspirations for the future, and far from totalizing, the variation and paradoxes inherent in the neoliberal project of distributing governance and centralizing capital provides numerous opportunities to mobilize alternate values and identities for positive social change (Brenner et al., 2010). However, resilience scholarship that does not acknowledge how socio-economic inequities alienate urban residents can unconsciously recreate those problematic dynamics and undermine its engagement with urban residents.

4.3. What ‘we’ do you speak of? Racial, ethnic, and cultural alienation

In the USA, economic segregation and stratification are bound up with beliefs about racial, ethnic, and cultural identities, especially if those beliefs support one's class positionality (Sakai, 2014). Thus, while socio-economic inequality has strong racial and ethnic corollaries, racial and ethnic alienation is also a process by which some groups are seen to have more social value than others, manifest in various forms of illegal and legalized discrimination, as well as the ways in which a perceived or realized sense of belonging to a given racial and ethnic group affects one's ability to communicate and collaborate with others outside of one's own group (Ramos and Hewstone, 2018).

Across cities in the USA institutionalized and personalized forms of racial and ethnic discrimination have shaped patterns of socio-economic and political inequality, which persist to this day (Rothstein, 2017) and have profound consequences for differential urban climate vulnerability. In Baltimore, MD and Portland, OR, for example, racist housing covenants restricted home purchasing to specific racial and ethnic groups from the 1920s into the late 1960s, mirroring broader patterns of institutionalized ‘red lining’, leading to systemic institutional disinvestment in communities categorized by race and ethnicity (Gibson, 2007; Pietila, 2012), with unequal occupational and environmental risks associated with climate change (Kinney, 2008). Within our own research praxis, we must pay careful attention to our own racial and ethnic situatedness and its influence on how and why we categorize different parts of cities according to racial and ethnic groupings and their attendant feelings of belonging, anxiety, stress, and intergroup competition (Ramos and Hewstone, 2018). While acknowledging these tensions requires emotional and psychological labor, failing to acknowledge them perpetuates the violence of a false-color blindness (Wise, 2010), deeply problematic for genuine dialogue, compassionate co-presence, and collaborative research.

4.4. Co-inhabitation and Othering: latent ableism and sensory alienation

The ways in which urban spaces have are designed to accommodate the sensory capacities of some people, while denying the capacities of others, highlights the limitation of the Habermasian speech ideal and its derivative of public discourse in overcoming the various ways that individuals suffer alienation. In the turn towards epistemological pluralism, sustainability and resilience science continue to rely on notions of ‘public talk’ or an expanded discourse space (Moore, 2006). However, a focus on ‘rational discourse,’ defined in the pragmatist sense of individuals discussing how to best meet their ‘interests’ vis-à-vis other social actors, is yet another way of circumscribing the political, while excluding other modes of experiencing urban space and relationships. Aside from ignoring the very real language barriers of contemporary metropolitan areas, the rational speech ideal and its derivatives assume that individuals are able to articulate their experiences and aspirations in ways that conform to the definition of sensible and rational discourse held by some community at large (Ranci  re, 2013; Cooren, 2000). However, these definitions of rational and sensible are not impartial modes of reasoning; rather, they are inherently normative conceptualizations of appropriate inference (Harman, 2002). Disability

scholars have identified the ideal as a primary strategy of perpetuating ableism in a diversity of social spheres (Cherney, 2011). Yet oral speech is but one communicative medium, and the largely visual language of planning (Fraser, 2019) also assumes that the visual dimension is the primary way in which urban space is experienced.

Sensory alienation results when we assume that individuals inhabit the same perceptual realm, and that quantitative differences in perceptive capability (e.g. receptivity to sounds of different decibels, visual acuity of different types of objects at different distances) automatically translate to qualitative differences in cognition and experience. Notions of differently abled individuals as inherently ‘less than’ those with other sensory capacities are an extreme form of sensory alienation, which is nevertheless continuously present in many social interactions and fora, and has been widely rejected in the disability literature (Goodley, 2014). We must therefore remain cognizant of how our perceptions of urban communities are subject to our own sensory capabilities, and remain open to alternative forms of perceiving and interpreting the urban world. Individuals of different sensory capacities or affordances, fundamentally inhabit urban space differently, and urban transformations must take their needs into account in order to be truly equitable, especially as those communities have often proved more than capable of generating their own communicative mediums appropriate to their sensory worlds, as in the case of ProTactile language emergence in the DeafBlind community (Edwards, 2012). Indeed, individuals within the DeafBlind and Deaf communities have undertaken a multitude of projects to restructure infrastructure and notions of space in ways that more adequately suit their needs, which are not restricted to their sensory capacities, but rather by social relationships that sustain them (Edwards, 2018; Byrd, 2017; Harrison, 2004).

5. Addressing alienation in urban resilience research: two examples

While the underlying social dynamics driving the alienation of urban experience cannot be eliminated or transcended merely by thinking differently, they need to be kept in mind while we engage in urban resilience research. Philosopher and cultural anthropologist David Abram (2011) reminds us how disconnected our notions of knowledge and experience have become:

“We are by now so accustomed to the cult of expertise that the very notion of honoring and paying heed to our directly felt experience of things—of insects and wooden floors, of broken-down cars and bird-pecked apples and the scents rising from the soil—seems odd and somewhat misguided as a way to find out what’s worth knowing.”

We are not here calling for knowledge *about* everyday experience. The goal is not simply to represent more diverse experiences in a discursive or quantitative form but rather to engage experience itself *as knowledge*. This is essential to redress the alienation born of a Cartesian paradigm insistent on the dualisms of self/world, mind/body, culture/nature (Laing, 1990). Abram (1997, 2011) and others working in the tradition of phenomenology and eco-psychology (e.g. Fisher, 2013; Naess, 1995) offer powerful guidance on how we might reconcile linguistic and sensory ways of knowing the world in a democratically accessible manner, but have not yet been widely taken up in urban settings. Such deeply transformative work can be conceptualized using the lens of ‘everyday’ life to evaluate one’s participation in broader processes of the social production of space, both through discourse and material practice (Lefebvre, 1991; Smith, 2008). The approaches of post-structural scholars such as Gibson-Graham (2003) can help us frame and analyze how different agents and social organizations construct meaning, identity, and agency in situating themselves within and advocating for change in social and economic structures. Such an approach must also attend to how hegemonic structures such as a globalized capitalism require social alienation to function (Heilbroner, 1985), and how researchers may unconsciously reproduce these same

dynamics they seek to address. Addressing alienation thus requires a daylighting of our own hidden assumptions about the appropriate role of expertise, our own social positionality (though a full reckoning requires understanding the role of gender – to which we refer the reader to Wijsman and Feagan, 2019 – in this issue). To this end, we present two concrete strategies for addressing alienation in urban research: building communities and relationships, and seeing research as a form of creative participation.

5.1. Building community relationships: rapport and experiential co-learning

First, resilience researchers need to pay attention to their relationships with the communities their research has potential to affect (Cook and Overpeck, 2018), and acknowledge that resilience research explicitly seeks to transform them in some way. To build just and transformative communities, we need to go beyond the mere integration of knowledge to strengthen the rapport among scientists, planners, non-humans, community activists, visual artists, writers, and urban residents through direct, personal relationships (akin to of Deleuze and Guattari’s ‘rhizomes’ (1987) in Purcell, 2013). Communities of shared affinity and vision are the most academically productive communities (Parker and Hackett, 2012), despite the fact that they work against predominant institutional models emphasizing competition. Such an approach builds off established research protocols in applied anthropological and social research, where scholars engage research participants in the formative stages of research, as well as throughout the process to facilitate an evolving research praxis (Baba, 2000; Spoon, 2014).

Such processes foster an affectively effective Sustainability Science, capable of entering into collaborations based upon emotional, moral, and/or aesthetic appeal with a wide range of social actors, while rigorously analyzing the likely and observed outcomes of particular resilience-oriented interventions. Engaging communities in the formative stages of research helps to define community members in an organic rather than a-priori manner, and allows for a deeply collaborative framing of research needs, questions, and goals.

In short, we promote research practices that fosters our own sense of ‘belonging’ in the city, a sensation and experience difficult to obtain in the Americas, as “Developing a sense of ourselves that would properly balance history and nature and space and time is a more difficult task than we would suspect and involves a radical reevaluation of the way we look at the world around us.” (Deloria, 2003: 61). Thus, there is a deep and problematic need to create ‘indigenist’ knowledge systems within settler colonial societies, which generate knowledge in relation to, rather than knowledge of, the experience of humans and non-humans alike (Kovach, 2015; TallBear, 2011).

Urban scholars have already undertaken similar methodological provocations, such as the practice of ‘walking with a critical eye’ to build up place-based and relational experiences of the urban built, environmental, and social fabric (Bassett, 2004), and experiential maps of complex urban spaces (Vaughan, 2009). In Phoenix and Lisbon, two participatory research efforts—Futurescape City Tours and the Finding Futures Project—engaged citizens in an urban walking experience, using photography to create a visual language about their experience and deliberations of technology and the city (Altamirano-Allende and Selin, 2016; Davies et al., 2013). Another such initiative is Adaptation: Combining Old and New Knowledge to Enable Conscious Transformations to Sustainability (AdaptationCONNECTS), which engages experiential learning through education and the arts on behalf of social transformation and climate change adaptation. Other examples include explorations of the urban fabric by means of active transportation such as bicycles (Spinney, 2009) and skateboarding, the latter of which highlights the importance of intrinsic motivation for alternative ways of engaging with the built environment (Seifert and Hedderson, 2010). While simply passing ‘through’ communities can be highly problematic if used to validate independently constructed assessments of their

status, there is a primal ‘truthiness’ and the embrace of the possibility for new social encounters to be formed by walking and being in communities that is otherwise impossible to obtain (Solnit, 2001).

Such co-presence not only forces us to confront our social situatedness (Chua, 2015) but also allows for simultaneous monitoring of our effectiveness as participants of transformative projects, as well as the effectiveness of those projects themselves. Such an approach transcends simple delineations between applied and basic research, as it calls for the creation of a sustainability science praxis (after Baba, 2000, echoed in Miller et al., 2014), which acknowledges a need for deep personal transformation in the line of research. Personal transformation entails a change one’s actual experience of the world, as well as shifts in intellectual and material practice, and the emotional growth that occurs when one reclaims agency through creative work.

5.2. Resilience scholarship as a creative practice: the role of art-science

By engaging communities in non-extractive and rapport building ways in the formative stages of research we lay the groundwork for acknowledging that resilience transformations are inherently contextual and subjective. Thus, the ways in which facts are used to motivate community transformation are often of secondary importance as compared to envisioning possible and desirable futures and of building relationships characterized by mutual respect. Creative and collaborative endeavors address the core of the human experience that engenders political and social movements—inciting and inspiring individuals, and forming the shared aesthetic and affective ideals needed for effective community and strategic alliances.

Such a reframing of research practice as a form of intellectual labor builds off of Marx’s original (1961) definition of labor which naturalizes labor as a ... ‘process in which both man and Nature participate, and in which man of his own accord starts, regulates, and controls the material re-actions between himself and Nature.’ This definition maintains human agency, yet grounds labor as a *transformative process*. Secondly, in terms of defining the products of labor as “... a result that already existed in the imagination of the laborer at its commencement,” Marx hints at the creative and imaginary capacities required for fruitful labor, while placing great emphasis on the human domination of the process. In contrast, Buddhist philosophers such as Coseru (2009) define the goal of intellectual labor as a process of accurately representing the process at hand to unify one’s perception, cognition, and action in the world. Such creative and participatory practice aligns with long standing theories of naturalized social organization that do not naturalize social difference so much as identify principles of inter-group and inter-species cooperation as the basis of evolutionary success and community formation (Kropotkin, 1922).

Presently, numerous art-science collaboratives have seized upon this notion of science as creative practice in envisioning both dystopian and desirable urban futures (Yusoff and Gabrys, 2011; Gabrys and Yusoff, 2012; Kinsella, 2018; Kormann, 2018). One particularly relevant example, the Bibatorium by Camp Little Hope, was a project exploring the future risks to drinking water in the Philadelphia metropolitan region. A collaborative of social practice artists, Camp Little Hope, brought together water resources specialists, interested public, and school groups through a 6-week interactive exhibit focused on envisioning the future of drinking water in their community in three possible scenarios as embodied by different types of boats. The first future demonstrated the impacts of climate change on sea level rise and the resulting salinization of drinking water sources as addressed through desalinization. The second scenario focused on the crumbling infrastructure of freshwater supply systems in the city, and the potential for privatization of the water supply through an exhibit of corporate run boats delivering water throughout the city. The last scenario focused on increased pressures from extractive technologies within the watershed, particularly hydraulic fracturing, through a boat hosting citizen scientists who patrolled and monitored the river system upstream of

Philadelphia.

These artistic representations of possible futures were designed to be provocations to the community to design their own boats in these possible future scenarios, and thus offering other alternatives to the issue presented. Through engaging discussion around the possible futures of drinking water in Philadelphia, they also covered contemporary and historical topics relationships between people and their environment. This community-focused, experiential art allowed people to share their own stories and ideas, while also learning new information and science relevant to drinking water and environmental sustainability in their urban community. Such art and science projects build off of a notion of cognitive evolution as within the broader evolutionary trajectory of life on earth (Bekoff, 2000; Vernadsky, 1945; Kropotkin, 1922). Adopting more compassionate ways of being, for fellow humans and non-humans, empowers and energizes science as social labor, a fact well recognized by artists engaged in ecological and environmental works (Ball et al., 2011). The other major lesson from the types of projects and works described by Ball et al. (2011), lie in their persuasive and socially invigorating dimensions—that the unification of art and science allows for the shaping of the public imagination and reclaiming the social power of media (Debord and Wolman, 1956). In this sense the power of art is not in simply making normative judgments about how the world ought to be but rather in conferring the experience of participating in transformative processes (Groys, 2012). Having an artistic practice, or one of freely engaging, in unplanned ways, with the environment should be built into scientific practice. Yet art-science cannot simplify fetishize the aesthetic, for the central purpose of unifying art and science is to mobilize social and political action.

6. In conclusion: experiencing climatic and system change

While overcoming alienation certainly requires building relationships and regaining control over affective structures and self-value, these are woefully inadequate without an experience of good governance, which can only be brought about by experiencing agency in institutions that are supposed to represent oneself. As urban areas worldwide brace for the increasing impacts of climate change and sea level rise, urban residents will continue to experience exacerbated uneven geographies of risk and vulnerability created by historical and ongoing processes of political and economic exclusion (Bennett et al., 2016; Anguelovski et al., 2016). Knowledge systems research in cities has a choice, it can attempt to improve knowledge for existing decision-making processes, or it can foster systemic change through new experiments in governance (Bulkeley and Castán Broto, 2013) to improve the nature of decision-making itself.

Such a practice adopts a model of science as a public service building broader civic capacity, which may not be seen as valuable by academics seeking to act as social change agents through established routes of policy and decision-making. However, given the urgency of present problems, we would be foolish to reject either established science-policy interfaces or more democratically and civically engaged routes. Such a plurality opens sustainability science to a much broader array of avenues for implementation, but may come at the cost of sacrificing some of science’s abstracted authority and social credibility, a situation often encountered when practicing hybrid science (Batterbury et al., 1997). However, we feel a turn towards experiential pluralism daylight an underlying political ideal held by sustainability science, of the possibility of genuinely collective and collaborative work that improves life for all urban residents while being attendant to the highly uneven social geographies of contemporary cities, ultimately making science more defensible to the publics it is seeking to aid.

As a final consideration, while we have been dismissive of the rational speech ideal in this manuscript, we still believe that experiential pluralism forms the basis for forms of urban governance and knowledge generation that adhere to underlying principles of sound governance: inclusivity, transparency, and accountability where the power of

persuasion outweighs the power of oppression (Alfred, 1999). Through the conceptual and methodological provocations provided here, we hope to energize urban resilience research to be deeply transformative in the interests of all urban inhabitants to build a more just and resilient urban future.

Acknowledgements

The authors would like to thank the conveners of the Third Annual Conference for Sustainability IGERTS held in Portland, Oregon, USA in September 2013, as well as Renee Hill for insight, comments and feedback on earlier versions of the manuscript. Further support for this work was provided from the NSF - Graduate Research Fellowship Program under Grant #DGE-1057604, and the NSF-IGERT Program under Grants #0966376, 0903479 and 0504248.

References

- Abram, D., 1997. *The Spell of the Sensuous: Perception and Language in a More-than-human World*. Vintage.
- Abram, D., 2011. *Becoming Animal: an Earthly Cosmology*. Vintage.
- Alfred, T., 1999. *Peace, Power, Righteousness: An Indigenous Manifesto* (Vol. 171). Oxford University Press, Toronto.
- Altamirano-Allende, C., Selin, C., 2016. Seeing the city: photography as a place of work. *J. Environ. Stud. Sci.* 6 (3), 460–469.
- Angelovski, I., Shi, L., Chu, E., Gallagher, D., Goh, K., Lamb, Z., et al., 2016. equity impacts of urban land use planning for climate adaptation: critical perspectives from the global north and south. *J. Plan. Educ. Res.* 36 (3), 333–348. <https://doi.org/10.1177/0739456X16645166>.
- Baba, M.L., 2000. Theories of practice in anthropology: a critical appraisal. *NAPA Bull.* 18 (1), 17–44.
- Bäckstrand, K., 2003. Civic science for sustainability: reframing the role of experts, policy-makers and citizens in environmental governance. *Glob. Environ. Polit.* 3 (4), 24–41.
- Ball, L., Collins, T., Goto, R., Damon, B., 2011. Environmental art as eco-cultural restoration. *Human Dimensions of Ecological Restoration*. Island Press/Center for Resource Economics, pp. 299–312.
- Bassett, K., 2004. Walking as an aesthetic practice and a critical tool: Some psychogeographic experiments. *J. Geogr. High. Educ.* 28 (3), 397–410.
- Batterbury, S., Forsyth, T., Thomson, K., 1997. Environmental transformations in developing countries: hybrid research and democratic policy. *Geogr. J.* 163 (2), 126–132.
- Becker, H.S. (Ed.), 1967. *The Other Side: Perspectives on Deviance* Vol. 196 Free Press.
- Bekoff, M., 2000. Animal emotions: exploring passionate natures. *BioScience* 50 (10), 861–870.
- Bennett, R., 2010. *EcoDISTRICTS Framework Concept for Metro Portland*. <http://oregonustainabilitycenter.files.wordpress.com/2009/05/ecodistricts-framework-plan-4-09.pdf>.
- Bennett, N.J., Blythe, J., Tyler, S., Ban, N.C., 2016. Communities and change in the anthropocene: understanding social-ecological vulnerability and planning adaptations to multiple interacting exposures. *Reg. Environ. Change* 16 (4), 907–926. <https://doi.org/10.1007/s10113-015-0839-5>.
- Bourdieu, P., 1998. *Practical Reason: on the Theory of Action*. Stanford University Press.
- Brenner, N., 2009. What is critical urban theory? *City: Anal. Urban Trends, Culture, Theory, Policy, Action* 13 (2-3), 198–207. <https://doi.org/10.1080/13604810902996466>.
- Brenner, N., Peck, J., Theodore, N., 2010. Variegated neoliberalization: geographies, modalities, pathways. *Glob. Netw.* 10 (2), 182–222.
- Bulkeley, H., Castán Broto, V., 2013. Government by experiment? Global cities and the governing of climate change. *Trans. Inst. Br. Geogr.* 38 (3), 361–375.
- Byrd, T., 2017. *Deaf space. Disability, Space, Architecture: A Reader*. Routledge, pp. 241–246.
- Callon, M., 1995. Four models for the dynamics of science. *Science and the Quest for Reality*. Palgrave Macmillan, London, pp. 249–292.
- Campbell, S., 1996. Green cities, growing cities, just cities?: Urban planning and the contradictions of sustainable development. *J. Am. Plan. Assoc.* 62 (3), 296–312.
- Cartwright, N., 1999. *The Dappled World: A Study of the Boundaries of Science*. Cambridge University Press.
- Cherney, J.L., 2011. The rhetoric of ableism. *Disabil. Stud. Q.* 31 (3). <https://doi.org/10.18061/dsq.v31i3.1665>.
- Chua, L., 2015. Troubled landscapes, troubling anthropology: co-presence, necessity, and the making of ethnographic knowledge. *J. R. Anthropol. Inst.* 21 (3), 641–659.
- Cook, B.R., Overpeck, J.T., 2018. *Relationship-building Between Climate Scientists and Publics As an Alternative to Information Transfer*. Wiley Interdisciplinary Reviews, Climate Change, pp. e570.
- Cooren, F., 2000. Toward another ideal speech situation: A critique of Habermas' re-interpretation of speech act theory. *Q. J. Speech* 86 (3), 295–317. <https://doi.org/10.1080/00335630009384298>.
- Coseriu, C., 2009. Naturalism and intentionality: a buddhist epistemological approach. *Asian Philos.* 19 (3), 239–264.
- Davies, S.R., Selin, C., Gano, G., Pereira, A., 2013. Finding futures: a spatio-visual experiment in participatory engagement. *Leonardo* 46 (1), 76–77.
- Davidson, M., Lees, L., 2010. New-build gentrification: its histories, trajectories, and critical geographies. *Popul. Space Place* 16 (5), 395–411.
- Debord, G., Wolman, G., 1956. *Methods of detournement*. Les Lèvres Nues 8 Online at: <http://www.cdcc.vt.edu/sionline/prestitu/usersguide.html>.
- Deloria, V., 2003. *God Is Red: a Native View of Religion*. Fulcrum Publishing.
- Edwards, T., 2012. Sensing the rhythms of everyday life: temporal integration and tactile translation in the Seattle Deaf-Blind Community. *Lang. Soc.* 41 (1), 29–71.
- Edwards, T., 2018. Re-channeling language: the mutual restructuring of language and infrastructure among deaf blind people at Gallaudet University. *J. Linguist. Anthropol.* 28 (3), 273–292.
- Ernstson, H., Van der Leeuw, S.E., Redman, C.L., Meffert, D.J., Davis, G., Alfsen, C., Elmqvist, T., 2010. Urban transitions: on urban resilience and human-dominated ecosystems. *Ambio* 39 (8), 531–545.
- Escobar, A., 1998. Whose knowledge, whose nature? Biodiversity, conservation, and the political ecology of social movements. *J. Political Ecol.* 5 (1), 53–82.
- Fazey, I., Moug, P., Allen, S., Beckmann, K., Blackwood, D., Bonaventura, M., Burnett, K., Danson, M., Falconer, R., Gagnon, A.S., Harkness, R., 2018. Transformation in a changing climate: a research agenda. *Clim. Dev.* 10 (3), 197–217.
- Feyerabend, P., 1993. *Against Method*. New Left Books.
- Fink, J.H., 2011. Cross-sector integration of urban information to enhance sustainable decision making. *IBM J. Res. Dev.* 55 (1&2) 12: 1–12: 8.
- Fisher, A., 2013. *Radical Ecopsychology: Psychology in the Service of Life*. SUNY Press.
- Fraser, B., 2019. Obsessively writing the Modern City: the partial madness of urban planning culture and the case of Arturo Soria Y Mata in Madrid, Spain. *J. Lit. Cult. Disabil. Stud.* 13 (1), 21–37.
- Gabrys, J., Yusoff, K., 2012. Arts, sciences and climate change: practices and politics at the threshold. *Sci. Cult.* 21 (1), 1–24.
- Gibson, K.J., 2007. Bleeding Albina: a history of community disinvestment, 1940–2000. *Transform. Anthropol.* 15 (1), 3–25.
- Gibson-Graham, J.K., 2003. *poststructural Interventions. A Companion to Economic Geography*. pp. 95–110.
- Gieryn, T.F., 2006. City as truth-spot: Laboratories and field-sites in urban studies. *Social Stud. Sci.* 36 (1), 5–38.
- Goodley, D., 2014. *Dis/ability Studies: Theorising Disablism and Ableism*, 1st edition. Routledge, Taylor & Francis Group, New York.
- Gould, K.A., Lewis, T.L., 2012. The environmental injustice of green gentrification: the case of Brooklyn's Prospect Park. *The World in Brooklyn: Gentrification, immigration, and ethnic politics in a global city* 113–146.
- Groys, B., 2012. *Art Power*. postmediabooks.
- Hardin, C.D., Conley, T.D., 2001. A relational approach to cognition: shared experience and relationship affirmation in social cognition. Moskowitz, Gordon B. (Ed.), 2001). *Cognitive Social Psychology: The Princeton Symposium on the Legacy and Future of Social Cognition*, (pp. 3–17) 503 pp.
- Harman, G., 2002. Internal critique: a logic is not a theory of reasoning and a theory of reasoning is not a logic. *Stud. Logic Pract. Reason.* 1, 171–186.
- Harrison, M., 2004. Defining housing quality and environment: disability, standards and social factors. *Hous. Stud.* 19 (5), 691–708.
- Heilbroner, R., 1985. *The Nature and Logic of Capitalism*. Norton, New York, NY.
- James, W., 1879. The sentiment of rationality. *Mind* 317–346.
- Jasanoff, S., Martello, M.L., Haas, P.M., 2004. *Earthly Politics: Local and Global in Environmental Governance*. MIT Press.
- Kaika, M., 2017. 'Don't call me resilient again!': the New Urban Agenda as immunology... or... what happens when communities refuse to be vaccinated with 'smart cities' and indicators. *Environ. Urban.* 29 (1), 89–102.
- Kingsland, Sharon E., 2005. *The Evolution of American Ecology, 1890–2000*. JHU Press, pp. 2005.
- Kinney, P.L., 2008. Climate change, air quality, and human health. *Am. J. Prev. Med.* 35 (5), 459–467.
- Kinsella, E., 2018. Can Artists Do Anything to Prevent Climate Change? Miami Beach Has Recruited One to Find Out. June 26. <https://news.artnet.com/art-world/miami-beach-artist-residency-rising-sea-levels-1306526>.
- Kormann, C., 2018. Miami Faces an Underwater Future. July 3. <https://www.newyorker.com/news/news-desk/miami-faces-an-underwater-future>.
- Kovach, M., 2015. Emerging from the margins: indigenous methodologies. Research as resistance: revisiting critical, Indigenous, and anti-oppressive approaches. pp. 43.
- Kropotkin, P.A., 1922. *Mutual Aid: A Factor of Evolution*. Knopf.
- Lachmund, J., 2013. *The Co-production of Science, Politics, and Urban Nature*. MIT Press, Greening Berlin.
- Laing, R.D., 1990. *The Politics of Experience and the Bird of Paradise*. Penguin, UK.
- Lawhon, M., Murphy, J.T., 2012. Socio-technical regimes and sustainability transitions: insights from political ecology. *Prog. Hum. Geogr.* 36 (3), 354–378.
- Lefebvre, H., 1991. *The Production of Space* Vol. 142 Blackwell, Oxford.
- Lesen, A.E., 2016. *Scientists, Experts, and Civic Engagement: Walking a Fine Line*. Routledge.
- Light, J.S., 2009. *The Nature of Cities: Ecological Visions and the American Urban Professions, 1920–1960*. Johns Hopkins University Press.
- Lubitow, A., Miller, T.R., 2013. Contesting Sustainability: Bikes, Race, and Politics in Portlandia. *Environ. Justice* 6 (4), 121–126.
- Marris, P., 2014. *Loss and Change (Psychology Revivals): Revised Edition*. Routledge.
- Martin, C.J., Evans, J., Karvonen, A., 2018. Smart and sustainable? Five tensions in the visions and practices of the smart-sustainable city in Europe and North America. *Technol. Forecast. Soc. Change* 133, 269–278.
- Marx, K., 1961. In: Engels, F. (Ed.), *Das Kapital: A Critique of Political Economy*. Gateway Editions.
- Massey, D.S., Tannen, J., 2018. *Suburbanization and segregation in the United States:*

- 1970–2010. *Ethnic and racial studies* 41 (9), 1594–1611.
- Mason, J., 2018. *Affinities: Potent Connections in Personal Life*. John Wiley & Sons.
- Miller, T.R., Baird, T.D., Littlefield, C.M., Kofinas, G., Chapin III, F.S., Redman, C.L., 2008. Epistemological pluralism: reorganizing interdisciplinary research. *Ecol. Soc.* 13 (2), 46.
- Miller, T.R., Wiek, A., Sarewitz, D., Robinson, J., Olsson, L., Kriebel, D., Loorbach, D., 2014. The future of sustainability science: a solutions-oriented research agenda. *Sustain. Sci.* 9 (2), 239–246.
- Moore, S.A., 2006. *Alternative Routes to the Sustainable City: Austin, Curitiba, and Frankfurt*. Lexington Books.
- Monteverdi, S., 2017. *Despite Progress, Northern Queens Homeowners Still Want to Opt Out of Green Infrastructure*. <https://qns.com/story/2017/02/23/despite-progress-northern-queens-homeowners-still-want-opt-green-infrastructure/>.
- Muñoz-Erickson, T., Miller, C.A., Miller, T.R., 2017. How Cities Think: Knowledge Co-Production for Urban Sustainability and Resilience. *Forests* 8 (6), 203. <https://doi.org/10.3390/f8060203>. Special Issue Tropical Forest Ecology and Management for the Anthropocene.
- Naess, A., 1995. The deep ecological movement. Chp. 9. In: Sessions, G. (Ed.), *Deep Ecology for the 21st Century: Readings on the Philosophy and Practice of the New Environmentalism*. Shambhala Books.
- Newell, P., Mulvaney, D., 2013. The political economy of the 'just transition'. *Geogr. J.* 179 (2), 132–140.
- O'Brien, K.L., 2016. Climate change and social transformations: is it time for a quantum leap? *Wiley Interdiscip. Rev.: Clim. Change* 7 (5), 618–626.
- O'Brien, K., 2018. Is the 1.5 C target possible? Exploring the three spheres of transformation. *Curr. Opin. Environ. Sustain.* 31, 153–160.
- Parker, J.N., Hackett, E.J., 2012. Hot spots and hot moments in scientific collaborations and social movements. *Am. Sociological Rev.* 77 (1), 21–44.
- Pietila, A., 2012. *Not in My Neighborhood: How Bigotry Shaped a Great American City*. Rowman & Littlefield.
- Purcell, M., 2013. *The Down-deep Delight of Democracy*. John Wiley & Sons.
- Ramos, M.R., Hewstone, M., 2018. The Good, the Bad, and the Long-term implications of social diversity. *Emerging Trends in the Social and Behavioral Sciences. American Cancer Society*, pp. 1–14. <https://doi.org/10.1002/9781118900772.etrds0465>.
- Rancière, J., 2013. *The Politics of Aesthetics*. A&C Black.
- Rothstein, R., 2017. *The Color of Law: A Forgotten History of How Our Government Segregated America*. Liveright Publishing.
- Sakai, J., 2014. *Settlers: The Mythology of the White Proletariat From the Mayflower to the Modern*. PM Press.
- Schacht, R., 2015. *Alienation*. Psychology Press, New York, NY.
- Scott, J.C., 1998. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. Yale University Press.
- Seeman, M., 1959. On the meaning of alienation. *Am. Sociol. Rev.* 24, 6.
- Seifert, T., Hedderson, C., 2010. Intrinsic motivation and flow in skateboarding: An ethnographic study. *J. Happiness Stud.* 11 (3), 277–292.
- Smith, N., 2008. *Uneven Development: Nature, Capital, and the Production of Space*. University of Georgia Press.
- Sohn-Rethel, A., 1978. *Intellectual and Manual Labour: A Critique of Epistemology*. Macmillan, London.
- Solnit, R., 2001. *Wanderlust: A History of Walking*. Penguin.
- Spinney, J., 2009. Cycling the city: movement, meaning and method. *Geogr. Compass* 3 (2), 817–835.
- Spoon, J., 2014. Quantitative, qualitative, and collaborative methods: approaching indigenous ecological knowledge heterogeneity. *Ecol. Soc.* 19 (3).
- Steele, W., MacCallum, D., Byrne, J., Houston, D., 2012. Planning the climate-just city. *Int. Plann. Stud.* 17 (1), 67–83.
- Stoker, G., 2016. *Why Politics Matters: Making Democracy Work*. Macmillan International Higher Education.
- TallBear, K., 2011. April. Why interspecies thinking needs indigenous standpoints. American Anthropological Association Meeting.
- Vaughan, L., 2009. Walking the line: affectively understanding and communicating the complexity of place. *Cartogr. J.* 46 (4), 316–322.
- Vernadsky, W.I., 1945. The biosphere and the noosphere. *Am. Sci.* 33 (1) xxii–12.
- Weichselgartner, J., Kaspersen, R., 2010. Barriers in the science-policy-practice interface: toward a knowledge-action-system in global environmental change research. *Glob. Environ. Chang. Part A* 20 (2), 266–277.
- Wendt, A., 2015. *Quantum Mind and Social Science*. Cambridge University Press.
- White, J.B., 2017. Facebook Allowed Racist Housing Adverts That Excluded Minorities. Retrieved January 31, 2019, from <http://www.independent.co.uk/life-style/gadgets-and-tech/facebook-housing-adverts-racism-minorities-excluded-a8068236.html>.
- Whitehead, A.N., 1925. *Science and the Modern World: Lowell Lectures*. Cambridge University Press.
- Wijsman, K., Feagan, M., 2019. Rethinking Knowledge Systems for Urban Resilience: Feminist and Decolonial Contributions to Just Transformations. *Journal of Environ. Sci. Policy (THIS SPECIAL ISSUE)*.
- Wise, T., 2010. *Colorblind: The Rise of Post-Racial Politics and the Retreat from Racial Equity*. City Lights Books.
- Wynne, B., 1992. Misunderstood misunderstanding: social identities and public uptake of science. *Public Underst. Sci.* 1 (3), 281–304.
- Yusoff, K., Gabrys, J., 2011. Climate change and the imagination. *Wiley Interdiscip. Rev. Clim. Change* 2 (4), 516–534.