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Finding feasible action towards urban transformations

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While innovative approaches to urban transformations are increasingly proposed, scholars often overlook challenges faced by endogenous actors (e.g. urban planners) tasked with taking action within non-ideal, real-world settings. Here we argue that an 'inside' view of transformations (focused on judgment in practice) is needed to complement existing 'outside' views (focused on assessment), where the feasibility of action becomes a central concern. This recasts urban transformations in a discretised perspective. It suggests a view of transformation pathways as both directed and stochastic, and emergent from an unfolding series of 'fuzzy action moments'. Principles for bridging urban science and planning are derived.

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Cities now face a variety of health, economic and environmental shocks that are likely to shape their course, and by extension global climate futures, for generations. In addition to longstanding and interrelated challenges such as pollution, poverty, inequality, and ecosystem (un)resilience[1,2], issues of climate change, pandemics, mass unemployment, and social unrest are now pervading cities globally[3–6]. While urban and global responses to Covid-19 have demonstrated that cohesive and timely responses to such threats are possible[7–9], we have not witnessed such rapid and shared responses for many longstanding urban sustainability challenges. Despite growing calls for urban transformations[10–12] and scaling of urban solutions across multiple planning sectors[13,14], both scientists and practitioners seem to be increasingly perplexed about how to realise these transformations in practice. Furthermore, while scientists emphasise the need for radical change, they often overlook the complex, contingent, and multi-faceted settings within which planners tasked with bringing about urban transformations are embedded.

Innovative frameworks[15] and roadmaps[16] have recently been offered for assessing and guiding urban sustainability transformations, as well as sustainability transformations at other scales[17–20]. Scholars are also increasingly interrogating the politics of transitions, including mechanisms of normalization, coalition building, and destabilisation that support scaling of innovations across jurisdictions, markets and societies[21–23]. At the same time, a range of novel approaches to urban intervention have been explored in both normative and critical terms, including green infrastructure[13,24–28], social capacities[29–31], co-production[13,32,33], emphasising the value of experimentalist approaches to urban transformation. These lines of thinking are formative and highly insightful. Yet they also tend to reflect an 'outside' perspective of urban transformations, viewing action formation from beyond the position of endogenous actors responsible for taking such action, and as a result, overlook the complexity of action formation itself. In other words, they do not put themselves 'in the shoes of a planner'. While there is no universal definition of a 'planner' (e.g. given different sectoral and hierarchical roles), this spotlights the vantage point of an endogenous actor expected to take action to advance urban transformations. Action formation is by no means straightforward and will be conditioned by a range of factors within non-ideal, real-world settings. For example, planners continuously need to make judgments and trade-offs under high scientific, political and legal uncertainty, in the face of competing demands and obligations, and within tightly circumscribed spheres of authority. How they may accomplish this is usually left implicit.

This calls into question the completeness of our current ways of thinking about urban transformations which tend to be premised on the idea that intentional action does (or at least can) be generated by those actors expected to do so. Yet different issues emerge when we consider the 'inside' perspective of planners, including differing expectations among decision-makers, competing obligations and responsibilities (e.g. legal, professional), limited resources and personnel, institutional norms and biases towards particular approaches, power asymmetries, variegated opportunities for joint decision-making (e.g. across departments and levels of governance)[32,34–39]. Altogether, this challenges scholars to consider multiple feasibilities of embedded action formation which inescapably confront real-world planners, in addition to the more commonly studied technical and/or economic feasibilities which tend to reflect a more limited rationalistic view of action. While existing scholarship on transformation increasingly engages with political, social and legal contexts of action, our argument is that it is not enough to only understand these contexts, as scholars also need to carefully consider their implications for prospective (i.e. forward-looking) action formation. This compels scholars to engage with the inescapable problem of *judgment in practice* (i.e. discerning a practicable course of action within a given set of real-world circumstances) which comes into focus from an inside perspective, alongside the problem of *assessment* (i.e. appraising or evaluating a process or outcome against a specific metric) that is visible from an outside perspective, as well as the problem of how both views may be brought together productively. In this Perspective, we critically synthesise a broad range of theoretical and empirical insights on this problem, and draw on four illustrative cases, to explore how an 'inside' perspective of action formation recasts our perspective of urban transformations.

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GETTING CLOSE TO THE URBAN ACTION

Recent scholarship examines urban action from various angles within a sustainability transformations agenda and draws attention to political dilemmas of strategic action in urban governance.

Green infrastructure literature has established that social and political barriers to transformation can emerge across sectors and scales[35,40,41], such as from disputes between state agencies and the city[29], tensions between science-informed planning and the often opportunistic nature of green infrastructure siting[24,42–44], and differences in priorities between communities and infrastructure managers[24]. This literature readily engages with the politics of urban action, but often critiques such processes using external normative frameworks, rather than specifically embracing the perspective of an endogenous actor facing an imperfect set of choices. Social capacities literature often observes a mismatch between existing urban governance regimes and the ability to bring about radical reconfiguration constituting transformation[45,46], exploring the integrative competencies believed to be needed such as mediation of interests and resources[47,48], cultivation and embedding of novelty[30,49], and ability to respond creatively to risk[49], among others. This literature takes an integrative, but also somewhat vague, perspective of competences for urban action, as defined by an external system observer concerned with prescribing transformations. Urban co-production literature argues that transformative urban action needs to arise through interaction between diverse geographically embedded actors (e.g. public authorities, businesses, citizens, scientists), and particularly emphasises the role of experimentation[35,47,50,51], as well as civic activism[52] and active citizenship[53]. This literature embraces the interactive nature of urban action but is often focused on specific emblematic examples or normative prescriptions based on outside-defined views of transformation. Some scholars come close to an inside view, such as efforts to combine political ecology with sustainability transitions[54], highlight the importance of 'effective politics'[55], or reframe urban action as centred on learning[37], but an explicit inside view remains underdeveloped.

While these literature suggest but do not yet encompass an inside view of urban transformations, they do highlight the complexity of particular contexts within which urban action is taken. As a result, a more fundamental tension comes into focus between the increasingly widespread scholarly prescriptions for transformation involving radical action, and the non-ideal and often tightly constrained nature of real-world decision-making settings; a tension which is increasingly stark. For example, diverse social, political, and legal scholarship suggests that complex decisional environments are the norm, including nonlinear relations between knowledge and action, a strongly social character of sustainability problems, non-automaticity of planned changes, non-pliability of many governance arrangements, and the potential for profound system uncertainty (Box 1). Consequently, the feasibility of urban actions is likely to be bounded, non-uniform in time and space, and vary with the position of the decision-maker. Getting a better handle on action formation, therefore, requires a grounded understanding of its feasibility in multiple senses, especially concerning political, social, and legal dimensions which are often under-appreciated.

Box 1 Core challenges for conceptualising action formation in urban sustainability transformations

I. Relationship between knowledge and action: Real-world decision making is influenced not only by technical knowledge (e.g. modelling, forecasts), but also many social factors (e.g. values, interests, lobbying, information/misinformation, cognitive dissonance, emotions). A simplistic model of knowledge-to-action is heavily critiqued but often continues to be replicated[91,92].

II. Social nature of sustainability problems: Scientists often assume that urban sustainability problems are largely technical rather than social in nature, as reflected by the emphasis on assessing benefits of planned sustainability interventions[25,26,87]. However, this can direct attention away from the political and legal struggles over urban sustainability choices.

III. Non-automaticity of change: There is frequently an assumption that system change will automatically follow a single intervention. However, interventions in one area typically have flow-on consequences elsewhere. Complex interdependencies (e.g. lock-ins[78]) invoke resistance and counter-actions which means that transformative change is anything but automatic[56].

IV. Non-pliability of urban governance arrangements: Related to point III, urban governance is often assumed to be pliable (e.g. achieving social consensus, institutional reform, creation/changes to law). But this is often unlikely. Social heterogeneity (e.g. mixes of interests, values, beliefs, and worldviews)[93], sticky institutions[75], complex sets of legal obligations across multiple levels and institutions[94], and broader political economies[95] impose brakes on radical action.

V. Potential for profound system uncertainty. While resilience thinking has convincingly established the need to pay attention to shocks, this often remains under-appreciated[96]. For example, the unprecedented COVID-19 crisis took cities across the globe by surprise, although the potential for profound disruption from escalating climate impacts, and social and economic forces (e.g. protests, economic insecurity) were already being experienced in many places. This shows how unplanned, transformative change may suddenly be needed outside the boundaries of pre-existing protocols for managing system shocks.

FEASIBILITY OF URBAN ACTION

The success of urban action in practice hinges on its feasibility in ways that go beyond merely technical and/or economic aspects. Yet, other feasibilities (political, social, legal) are often poorly recognised. Recently, there is growing, although nascent, attention to the political feasibility of policy intervention in climate governance[56–58], and in wider political theory[59–61]. Implicit concerns about feasibility can also be witnessed in wider debates about trade-offs between social acceptability and the technical feasibility of planned solutions[62,63]. The notion of feasibility seeks to apprehend the degree to which a given course of action conducted by certain agents is achievable within a given setting and moment in time[56,60]. This reflects a view of feasibility as capability—not only a potential for action (e.g. capacity) but also the ability to realise this action within a given set of social and material circumstances. Yet, it is also an intersubjective property, arising from shared beliefs among endogenous actors in a given setting. Hence, what is considered feasible may also change over time[56,57,59], for example, as debates and narratives about sustainability evolve (e.g. imaginaries, norms), in response to external shocks (e.g. climate-related shocks, social mobilisation), and as pathways themselves unfold changing the calculus of a particular intervention (e.g. interests, preferences).

Here we unbundle political, social, and legal feasibilities, building on prior work[56–58,60,64], distinguishing their differing elements and factors. Political feasibility focuses on institutional and organisational decision-making, social feasibility focuses on the interaction with broader society, and legal feasibility focuses on the legal and regulatory domain. These feasibilities are determined by interactions among actors within socio-technical-environmental systems. For example, political feasibility links to human geography (e.g. configurations of people and infrastructure) and economic geography (e.g. sources and locations of jobs). Social feasibility links to everyday patterns of behaviour (e.g. mobility, work, leisure), lifestyle (e.g. amenity, customs), and public opinion (e.g. preferences, values). Legal feasibility links to the formal setup and functional operation (institutional, procedural, substantive elements) of legal systems. Table 1 shows that a range of factors can influence each dimension. Our aim is not to develop a holistic feasibility framework, but rather, to elaborate on dimensions of feasibility that are especially salient from the standpoint of a real-world planner although are not typically given sufficient attention by scholars. Urban action will of course be embedded within material settings (e.g. environmental, infrastructural) which condition the very types of responses that can be considered.

Table 1. Factors that can influence the feasibility of urban action.

Dimension	Element	Factors
Political feasibility	Political work[29,30,64,75,76]	• Presence of change agents at critical points where actions are needed. • Intensity of resistance to change. • Presence of support from higher authorities. • Open or closed disposition within system to new ideas and practices.
	Conflict[14,29,77]	• Degree of agreement or disagreement about urban transformations. • Relative strength of coalitions for and against change. • Dilemmas over policy choices (e.g. difficulties dealing with policy 'losers').
	Institutions[58,75,78]	• Degree of path dependency of existing institutions (e.g. inertia, lock-in). • Degree to which institutions permit or block various urban actions. • Likelihood of achieving institutional reforms (e.g. policy and legal changes).
	Organisations[58]	• Resource availability (e.g. short-term projects, long-term funding streams). • Alignment with planning cycles, both within and across organisations. • Presence of supportive networks within and across organisations.
	Political systems[64,65,79,80]	• Electoral cycles and windows of opportunity presented for strategic action. • Veto power of incumbents (e.g. administrators, elected officials, business councils, unions). • Support from elected officials to enact certain policy or legislation.
	Ideational setting[14,56,81]	• Presence of knowledge about sustainability problems and solutions. • Prior experience of innovation and/or experimentation. • Presence of compelling discourses about sustainability.
Social feasibility	Public awareness[58]	• Public opinion and values on sustainability and related issues. • Presence of change agents influencing public opinion about sustainability. • Presence of social movements for or against sustainability.
	Practices and behaviours[30,33,76,82]	• Degree of alignment between a new intervention and existing everyday practices (e.g. habits, routines, norms), especially those that are 'locked-in'. • Likelihood of new practices and/or behaviours forming. • Presence of adverse consequences from new interventions for people.
	Social psychology[14,83,84]	• Cognitive responses to sustainability information (e.g. acceptance/rejection, dissonance). • Affective responses to sustainability issues (e.g. emotion, overwhelm, motivation). • Context of post-truth politics (e.g. misinformation, polarisation).
	Legitimacy[56,58,85,86]	• Perceptions of fairness including differential impacts on social groups (e.g. wealth, race, gender, disability) in the context of social and cultural histories. • Degree of trust in public authority among citizens. • Alignment between problem frames and societal values. • Engaging narratives (e.g. Green Deals, crisis recovery, social justice).
Legal feasibility	Institutions[87–90]	• Separation of powers between legislative, executive and judicial branches of government • Hierarchical legal authority across levels (e.g. devolution of power from federal to state, or state to city or local levels) • Inherent sectoral setup of the law (e.g. water, energy, spatial planning, nature, public finance, infrastructure) • Constitutional constraints and obligations (e.g. basic and human rights, such as property rights and right to a healthy environment)
	Procedures[88,90]	• Access to justice, due process and fair trial requirements (e.g. in which process are matters decided; who can appeal and on what grounds; what kind of evidence is required or allowed in the process)
	Substantive provisions[87,89,90]	• Criteria that must be taken into account (e.g. planning criteria such as mobility, utility services, and recreational areas) • Requirements to achieve certain outcomes (e.g. service levels) • Dis-allowance of certain actions (e.g. value neutrality in public financing)

Source: Compilation based on cited sources and authors' experience.

While navigating multiple feasibilities is vital for realising successful action towards urban sustainability transformations, they will manifest in potentially complex ways in particular *moments of action* within particular settings. This notion of moments of action is broader than the idea of a window of opportunity[65] (although action moments may sometimes arise from such windows), as it instead delineates a 'bundle' of connected activities occurring over a continuous period of time linked to a certain decision or initiative (e.g. planning process, design of a regulatory framework, urban renewal project). Thus, it refers pragmatically to the periods in which a particular activity is focused on (deliberately) or confronted (due to circumstances) which necessitates decisions and/or actions, as this appears in the work of a planner.

For example, in Helsinki, Finland, an initiative to transform major road thoroughfares into 'city boulevards' supporting public and active transport through green space planning encountered several feasibility issues including political (i.e. resisting coalitions, institutional path-dependency), social (i.e. clashes with existing practices and behaviours), and legal (i.e. court challenges, interplay of hierarchical legal authorities, clash with required legal provisions), which significantly slowed down planning to transform mobility in and out of Helsinki (Supplementary note 1). In Medellín, Colombia the Centurón Verde, an ambitious programme to encircle the city with a green belt to address issues such as poverty and poor environmental quality, has been viewed internationally as an exemplar of integrated planning and

collaboration with communities, although it has also been criticised for insufficient attention to inequality and marginalised communities. In this case, the green belt is ecologically connected to its relatively more biodiverse hinterland, thus offering opportunities for biodiversity enhancement and ecosystem services restoration. This case demonstrates political feasibility (i.e. generating agreement, sustaining action across elector cycles) and social feasibility (i.e. broad social acceptance and trust), but questions over social feasibility have also arisen (i.e. regarding impacts on poorer residents) (Supplementary note 2). In London, UK, a citywide London Environment Strategy was launched in 2018 aiming to address interconnected environment and health issues, and significantly scale out green infrastructure across the entire city. To date, the strategy has shown political feasibility (i.e. continued Mayoral support for the initiative across multiple tenures) and social feasibility (i.e. sustained public awareness and support). However, the legal feasibility remains to be tested, particularly as the UK diverges from Europe and sets new national frameworks (Supplementary note 3). In Seoul, South Korea, the Cheonggyecheon river restoration project completed in 2005 sought to regenerate an area of urban decay and improve environmental (air, noise) quality. While the river in question is a facsimile of the original watercourse, it provided an opportunity for urban intervention in the material fabric of the city. This is an exemplar of political feasibility (i.e. support from higher authorities, overcoming path dependency) and social feasibility (i.e. changing drivers of behaviour, public awareness), though some issues are unresolved (e.g. equity) in terms of green gentrification. Legal feasibility is clear, although while involving cross-sectoral agreements (i.e. water, transport, finance), the river will continually require ongoing financial support (Supplementary note 4).

These cases exemplify nuanced combinations of feasibilities confronting planners involved in urban transformation in practice. London and Medellín illustrate the potency of a consistent transformation vision across electoral cycles, and Seoul and Medellín show that this vision assists in changing citizen behaviour. However, social feasibility can also include ethical aspects (e.g. equity, justice). The Medellín and Helsinki cases show contestation between local communities and official planning agendas, while the Seoul case demonstrates gentrification. On the other hand, in London and Seoul communities chose to adopt their cities' greening strategy possibly because it gives local authorities access to funding for urban greening that constituents desire. All cases suggest the necessity of collaboration for navigating multiple feasibiltiies[66], both among diverse social actors but also crucially among governmental authorities themselves. Consequences for urban transformation unfold over short and long timeframes. In Seoul, motorway removal forced changes to transport behaviours and stimulated changes in urban imaginaries. Yet, in Helsinki while it is clear that diversification in public mobility is needed at scale, a solution is still to be found. In Medellín, green infrastructure is reshaping the urban environment, but addressing social issues remains a challenge for equitable urban transformations. This has lessons for London, where successful on ground implementation of green infrastructure in coming years may require diverse solutions to meet community needs and expectations.

The four cases are, therefore, suggestive of a range of feasibility challenges for action formation. Yet there are also limits to what can be gleaned from these cases regarding a genuinely inside perspective on urban action, particularly across a variety of planners and decision-makers within the cases. The cases are, therefore, emblematic and provide a provocation for the relevance of these issues in future work. Moreover, the specific character of feasibility challenges could vary between cities, especially across global South and North contexts. For example, characteristics of cities in the global South may differ in terms of population growth, poverty and inequality, economic development, infrastructure gaps, institutional challenges (e.g. corruption), and post-colonial histories[67–69]. Thus, the dimensions of feasibility in Table 1 are not intended to be exhaustive but, rather, illustrative of the arenas that scholars need to project themselves into when seeking to understand and support transformative urban action.

'FUZZY ACTION MOMENTS' AS BUILDING BLOCKS OF TRANSFORMATION PATHWAYS

Both theory and practice suggest that planners are confronted with an ongoing series of relatively discrete but often ill-defined (i.e. fuzzy) moments, which may (or may not) permit intervention towards urban sustainability transformations. Each moment involves juggling competing expectations and objectives, mediating between interests (e.g. among elected officials, industry groups, unions, and citizens), ensuring legal obligations are adhered to, and incorporating scientific and other sources of knowledge into decision-making. Hence, from the perspective of a planner, urban sustainability transformations appear not as an overarching or coherent system trajectory to follow, but rather as an unfolding series of moments requiring interpretation and decision-making under uncertainty, often without guarantee of clear or satisfactory outcomes. In other words, urban transformation pathways emerge from an unfolding series of 'fuzzy action moments' (Fig. 1).

Fuzzy action moments provide an empirical anchor for apprehending action formation within specific situations involving feasibility challenges. These action moments are comprised of interactional situations involving activities that are bounded in time and issue focus. For example, this may concern steering (e.g. formation of a policy, plan, or regulation), investment (e.g. infrastructure, services), or operations (e.g. infrastructure maintenance, enforcement of regulation). The idea of action moments resonates with the notion of action situations advanced by Elinor Ostrom[70] which emphasises the complex interactional structure of a jointly dependent situation involving multiple actors. Moreover, following the notion of polycentricity[71,72], fuzzy action moments may also be dispersed structurally across different venues within an urban governance setting. But fuzzy action moments, as described here, also explicitly include a temporal component, since uncertainty and ambiguity grow over time, even within the duration of a single action moment. A fuzzy action moment is not necessarily clearly bounded nor stable over time; its fuzziness arises from both epistemic and temporal uncertainty. A pathway as a whole also becomes increasingly opaque looking further into the future. Hence, within each individual moment there will be an immediate or proximate timeframe of consideration, and when we view pathways as a series of relatively discrete unfolding moments over an extended trajectory, different sorts of interventions may also come into focus as more or less feasible at different times.

The notion of pathways is common in theory on sustainability transformations and is employed here to conceptualise evolving trajectories of effects moving from the present towards (or away from) qualitatively more sustainable futures (however defined). Transformation pathways have been conceptualised in various ways, including as ongoing decision cycles navigating an external landscape[18], and as branching trajectories comprised of both directed and abrupt transformations within a dynamic zone of resilience[15]. Although, in both cases the perspective for navigating transformations ultimately resides in an outside, whole-system view, whereas the perspective of endogenous actors may be far more bounded, but also confronted with many feasibility considerations that a whole-system view does not see. Combining existing theories of transformation pathways with the bottom-up notion of fuzzy action moments offers an enriched conceptualisation of urban transformations bringing outside and inside views of transformations into productive dialogue (Table 2).

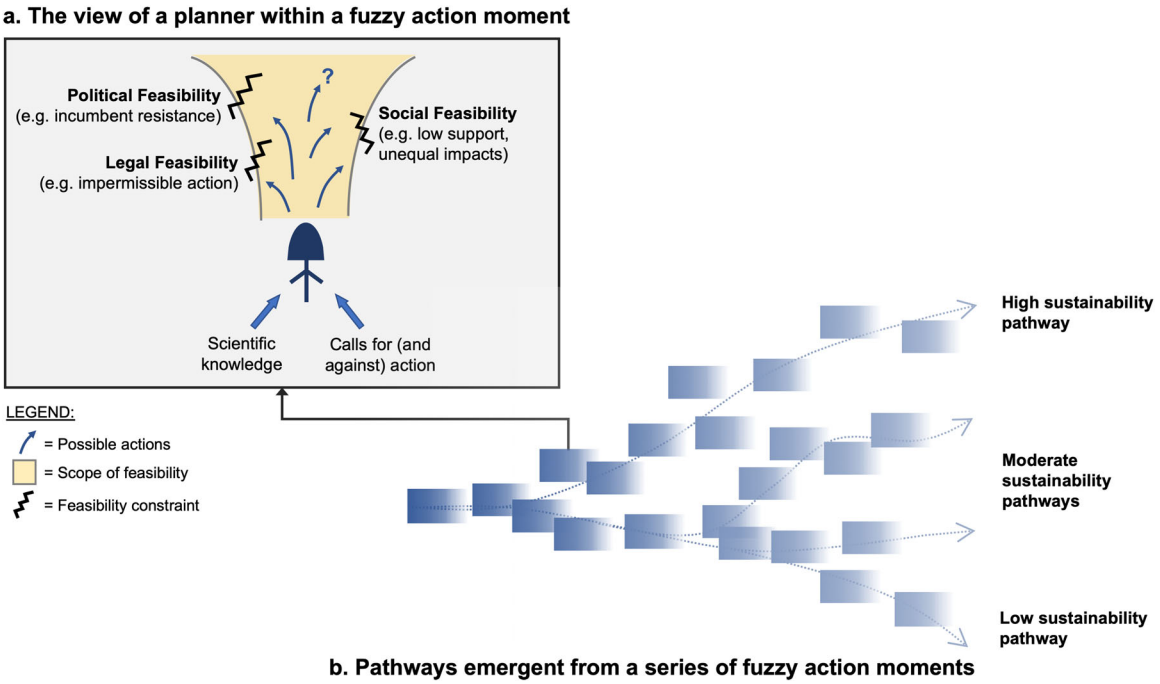

Fig. 1 Transformation pathways emerge over time. Conceptualisation of sustainability transformation pathways as an unfolding series of fuzzy action moments. **a** Standing in the shoes of a planner suggests a range of feasibility considerations for action in a given moment, while **b** pathways of transformation may (or may not) emerge from the cumulation of a series of fuzzy action moments over time.

Table 2. Comparison of 'outside' and 'inside' views of urban transformation pathways.

Attribute	Outside view	Inside view
Focal scale	Whole system	Fuzzy action moment (concerning certain aspect(s) of the system)
Imperative	Assessment of system properties	Judgment of appropriate action
Knowability	Can map alternative pathways towards an overall goal, at least broadly	Cannot map pathways very far in advance, and must accept open-endedness about the future
Navigation involves…	Path following and correction	Path creation and experimentation
Temporal pattern of action	Continuous action	Discrete and irregular 'chunks' of action
Nature of action	Informed, consensual, reflexive	Bounded, conflictual, ad hoc
Benefit of approach	Assessing and inspiring whole system change; Capturing systemic dynamics that may otherwise be missed	Illuminating real-world dilemmas of endogenous action; Capturing internal struggles that may otherwise be missed

Fuzzy action moments represent ongoing, albeit irregular, moments of possibility for urban action towards transformation, emphasising a focus on path-creation rather than path-following, where desirable pathways are not easy to know too far into the future, and might not be rationally corrected for along the way. Hence, transformation pathways may themselves often be ambiguous, both due to successes/failures from intentional action as well as stochastic variation, and also because cumulative effects from multiple fuzzy action moments may take time to become distinctly apparent. Consequently, the implementation of sustainability pathways cannot be fully planned in advance. Overall, this comprises a pragmatic approach to transformation that also maintains an eye on the whole system. In this sense, it resonates with experimentalist approaches that seek to explore creative possibilities for action. But it also differs by foregrounding the variegated opportunities for action, especially by those bearing responsibility for weighing competing demands, reconciling deep contradictions between sustainability imperatives and current practices[73], and working within governance structures that rarely permit radical change.

NAVIGATING TOWARDS URBAN SUSTAINABILITY TRANSFORMATIONS

The approach proposed here adds a complementary 'inside' angle to urban transformations research, which also has important implications for our understanding of how transformation pathways may be navigated. Despite the proliferation of calls for urban transformations, the concrete ways in which planners are actually expected to work towards such changes are often highly unclear. To address this blind spot, we argue that urban sustainability transformations need to be viewed from a coupled inside-outside perspective, and we outline an approach for strengthening the relatively neglected inside view, anchored in a sober recognition of multiple dimensions of feasibility shaping urban action.

This leads to several key guidelines for urban transformations scholarship:

1. Strategic urban action which takes feasibility into account is continuously required to advance urban transformations.

Transformation pathways are unlikely to automatically emerge, but instead will require ongoing work and struggle to keep pushing forward.

2. The patterns by which transformation pathways emerge may reflect much 'muddling through'. Scholars often disparage incremental change, but the common dichotomy between incremental and transformative change is called into question when recognising the position of the planner embedded within non-ideal, real-world settings. What arguably matters more is distinguishing meaningful from non-meaningful changes (however defined). Many seemingly mundane actions (e.g. patient negotiation and persuasion, influencing slow-moving planning and budgetary cycles, finding workable compromises) should be more highly valued in conceptualisations of transformations. This also resonates with the notion of 'radical incrementalism'[74].
3. Images of transformation might not be glamorous and are unlikely to involve a single moment of radical reconfiguration. Urban action will be messy, and planners need to find ways to overcome many feasibility constraints. Action may also occur in multiple decision-making loci with complementary or conflicting outcomes. The overall effects vis-à-vis transformation may be difficult to predict. Moreover, in many cities particularly in the global South, equitable transformation will require carefully integrating informality over time.
4. A key opportunity to support urban transformations is to 'join-up' multiple action moments to accelerate and strengthen urban transformations. If transformations are unfolding patchworks within complex contexts, then an overarching opportunity may also exist to leverage the potential for systemic shifts that could not be achieved through isolated actions alone but only through their combination. Agents who can connect/join these multiple action moments may be key to the acceleration of urban transformations. Yet on the other hand, acceleration may also be risky because it could limit the feasibility of some actions. Sometimes, a sustainable pathway may require slowing down decision-making at certain points (e.g. to include unheard voices or reshape agendas to better serve marginalised groups).
5. Attention to feasibility should not suggest undue caution but rather bolster aspirations for transformation. A focus on feasibility should empower proactive engagement with the dynamic possibilities for action in a particular setting (including the environmental and infrastructural context) and thereby enable savvier forms of action. It also stands to help spur continuous learning about urban transformations in practice.
6. It is incumbent upon scientists to sympathetically explore opportunities for action from an 'inside' perspective if sustainability transformations are to be realised. Engaging with the realities of endogenous actors (e.g. what does it mean to be an agent within a complex system?) presents major opportunities to help bridge urban science and planning, innovate solutions-focused research for urban sustainability, and even reimagine urban complexity.

DATA AVAILABILITY

The authors declare that all data supporting the findings of this study are available within the paper and its Supplementary information files.

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The authors declare no competing interests.

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