Transforming the Engineering of Cities: ‘Points of Departure’ for Future Visioning

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Abstract

There is growing recognition that urban design and planning practices are ill-equipped to deal with the challenges of the future. Given shifts in demographic patterns, the effects of climate change and economic uncertainty, there is a pressing need for alternative approaches to solve complex challenges and to craft new urban futures. If we are to envision futures, there needs to be a rigorous questioning of urban design and planning practices. From the findings of the Transforming the Engineering of Cities Program (TEC), an ambitious 5-year multi-disciplinary research program, we argue that there are three “points of departure” that can be employed in engineering cities for the future. They are starting points for thinking through how we approach crafting urban futures by: 1.‘Re-thinking engineering principles and practice’ 2. ‘Re-imagining the function and form of the city itself’ and 3. ‘Understanding of the city as a social system.’ The implications of these departure points are ways to transform future visioning for projecting and crafting urban futures.
I. Introduction

The purpose of this paper is to discuss lessons the Transforming the Engineering of Cities Program (TEC) program that can inform and equip the current context for engineering to envision and prepare for unknown futures. The TEC programme uses a multi-disciplinary approach to transform the engineering of cities for societal and planetary well-being within the context of low carbon living and resource security, using tools and approaches from disciplines such as engineering, public policy, psychology and economics.

The research programme has included 2 distinct phases. Phase 1 organized the team into 5 thematic areas related to specific universities’ projects of interests. This included: 1) city analysis 2) well-being 3) energy 4) policy, governance and economics 5) future visions. Using high-level discussions, consultation and a mapping exercise to understand shared goals, there was a reorganization to frame the work of Phase 2 in a more interdisciplinary manner, using adopting the following themes: 1) Sharing City 2) Radical Mobilities City 3) The Ecosystem Serviced City 4) the Re-Zoned City 5) City of Synthesised Flows 6) Investing City and 7) Transforming the Liveability of Cities 7) Gendered City 8) Choreographing the City. Each of the phase two projects incorporated the multi-disciplinary expertise built in phase one, in order to create more interdisciplinary projects. Identifying lessons to inform and equip the current context for engineering vision will draw upon work from Phase 2 of the research program.

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1 The City Analysis theme aimed to understand the supply resources to cities. The wellbeing theme aimed to understand individual and societal wellbeing with particular attention to the aspirations and mobilities’ aspects of urban life. The energy theme sought to understand the context for low-carbon energy supply and security. The policy, governance and economics themes looked closely at re-engineering the machinery of policy-making and re-envision of city financial models. Finally, future visions looked at how to develop future visions for liveable cities.
In reviewing the work of Phase 2, this paper asks the question “what lessons from the TEC programme can inform and equip the profession in approaching challenges and crafting urban futures?” There are numerous specific findings from the research programme, but this paper focuses on a meta-analysis of the programme to discuss the implications of findings for engineering practice across all the various contributions. We delineate three ‘departure points’ for conceptualizing urban futures that emerge when reviewing outputs of the project. They are:

1. Re-thinking engineering principles and practice (designer focused)
2. Re-imagining the function and form of the city itself (urban design focus)
3. Understanding of the city as a social system (user focused)

This paper includes these three points of departure for envisioning futures featuring examples from the TEC program. These case studies contribute to a discussion of how urban futures are currently crafted (Hanson, 2015). This paper aims to contribute the strengths of these departure points and the implications of applying these for urban engineering futures.

II. Method

The TEC program produced 10 white papers which provide insights and alternative approaches intended for a policy and design audience based on the research of the individual research streams. For a full list and references to the white papers, please refer to the References. These white papers were written for a policy audience and treated here as primary evidence from the research streams.
For the purpose of this paper, the white papers were reviewed to identify core aims, insights, alternative scenarios and best practices to inform new forms of projecting and crafting urban futures. Then, using a grounded theory approach, findings from the white papers (aims, insights, scenarios and best practices) were grouped according to common themes that emerged. This approach to grouping the themes was conducted by two researchers in order to compare and to probe any differences in the themes that might arise. The subsequent sections will discuss the results from the TEC program through the lens of points of departure and their implications for “lessons from the TEC programme that can inform and equip approaches to tackle challenges in, project and craft urban futures.”

III. Results

The main finding of this analysis was evidence of three typologies for differences in the “points of departure” when researching the future of cities. These points of departure can be understood as starting points for how we might rethink the engineering and design of cities. The point of departure is of significance because it frames the stage at which the intervention is applied and where changes in current thinking begin (or depart from) as featured in ‘
Figure 1 Points of departure
Applying this to tackle a problem provides three departure points from which to choose. If approaching a problem such as congestion for example, an intervention or ‘solution’ would yield different perspectives depending on whether the point of departure is designer-centered, urban form centered or user-centered. While not explored in this paper, the outcomes from the respective point of departure would not necessarily be the same given a difference in point of departure. However, as shown in ‘Figure 2: Applying departure points to an urban challenge’, thinking through which starting point, provides an awareness of the points of departure relative to a desired outcome. Table 1: Points of Departure in TEC projects provides the results of this identifying points of departure in the current TEC projects from Phase 2.
Figure 2 Applying departure points to an urban challenge

Which point of departure would you choose to solve this challenge?
<table>
<thead>
<tr>
<th>Point of Departure</th>
<th>Project Examples</th>
<th>Aims</th>
<th>Alternative approaches include:</th>
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| **Designer-centred**  
**“Rethinking engineering principles and practice”** | 1. **UK City Life (CAM), University of Birmingham**  
The UK City LIFE, “CAM” aims to incorporate social metrics within an indicator-based metric in order to assist councils in understanding how their city is performing. | Contributing a comprehensive assessment to assist councils in understanding how their city is performing, to develop and operationalize activities to achieve the city’s future visions. | |
| 2. **Urban principles and pathways for future city vision, University College London**  
Through sectoral visioning workshops in 8 cities in the UK, this project engaged stakeholders for urban projects, policymakers and civil society in a creative process of crafting a vision. | Beginning with a high level vision (evidence from transformative behaviors often with political leadership/strong participatory processes) and high level imaginaries. | |
| 3. **Choreographing the city, University College of London**  
To develop a concept where engineers and choreographers explore what they may learn from one another about design approaches. | Taking into account the different approaches and similarities to space that choreography and engineering bring (ie. both practices deal with curating space, form and flow). | |
| 4. **Governance of Smart Cities, University College of London**  
This aims to explore mechanisms for urban innovators to leverage city government data to progress their ideas, projects and businesses taking into account fundamental characteristics of a smart city. | Demystifying opportunities for tech innovators to leverage and navigate governance systems to Progress their innovations, setting out recommendations to local government about how they facilitate the tech market to meet agendas. | |
| **Urban form centred**  
**“Reimagining the function and form of a city”** | 1. **Sharing City, University of Lancaster**  
It aims to make visible the ways in which sharing is arranged through a series of workshops with citizens of Lancaster and Birmingham and creating a typology, focusing on sharing in cities. | Different dimensions of sharing and models of sharing, methods for designing communication platforms that integrate the different dimensions and actors of sharing in localized conversations. | |
| 2. **Contribution of urban metabolism in transforming the engineering of cities for global and societal well-being, University of Southampton**  
This project aims to offer insight and highlight how cities work in terms of the resources that flow through, the wastes they produce and structures they build. | Improving links between urban metabolism and life cycle analysis, taking into account scales of governance and frameworks for for sustainability, climate change, and low carbon living. | |
| 3. **‘Car-free’ City, University of Birmingham**  
The “car free city” is a project that aims to provide evidence to promote the elimination of cars in cities. This approach reimagines a city by “(re)designing an alternative to what has been called an ‘autopia’. | Providing alternative scenarios for how people live and work and interact to alter energy consumption profiles and shifting towards decentralized electricity networks and local energy consumption. | |
| **User-centred design**  
**“Reimagining the function and form of a city”** | 1. **UK City Dweller Aspirations for Cities for the Future and for Themselves: a study of London and Birmingham, University College London**  
Aims to inform policy and practice to promote wellbeing and reduce carbon by looking closely at what city-dwellers want for themselves in order to assess what they aspire to for their lives. | Providing evidence to support the synergy between carbon reduction initiatives and individual well-being, promoting communal ways of living, spaces that are family-friendly and community-friendly and other connection strong aspects. | |
| 2. **Designing for Well-being in Birmingham, Lancaster and Southampton**  
This project aims to address a gap in research looking at the combination of deprivation, population density and well-being in Birmingham. | Applying an inclusive approach to urban planning, designing and policy making for enabling wellbeing in cities. | |
1. Re-thinking engineering principles and practice (Designer-centered)

In this point of departure, an approach for crafting urban futures begins with examining how the designer thinks about the process itself, what views and knowledge he/she is building upon and how this informs processes for decision-making and planning.

The case studies from the TEC program that apply this point of departure in Table 1 challenge engineering and design thinking in different ways. In one project, the designer includes social metrics within indicators. In another, the designer positions future visioning as an ongoing, dynamic and people-centered process and in other examples, the designer provides alternative views to the normative ways in which designers interact in the cities they are designing. The following section will discuss the implications of applying this type of thinking in engineering practice.

Implications of applying the designer-centered point of departure

1.1 “Social metrics are incorporated in decision-making”: The UK City Life

The UK City Life project suggests a need for a shift in engineering thinking by changing the tools designers use to measure and determine solutions. The implication of this type of thinking is that social metrics are incorporated in the tools (indicators) that the engineer (or other designer) uses to inform decision-making.
As indicators are one of the ways in which designers measure performance in cities to inform decision-making, the indicators chosen and applied depend on the principles and perspective of the designer and institutions that employ them. This example also suggests an alternative approach that would “put social metrics alongside “green indicators” (Leach, n.d.). The implications of this approach is that designers shift core principles in engineering through inclusion of social metrics. This can be applied in a variety of ways that include: decision making frameworks for policy, city performance targets for future city visions and/or trend analysis of social metrics in green indicators over time.

1.2 “Visioning as a process”: Urban Principles and Pathways for Future Visions

The Future Visions project proposes as series of urban principles and pathways that shift future visioning from a stage in a design process to an ongoing process, from a static process to a dynamic process and from an institution-centered approach to a people-centered (end user) approach. The effect of this point of departure is that it shifts engineering principles around visioning as a step at the ideation and design stage towards an ongoing component of a design process - transforming the vision for what engineering should achieve. The researchers describe this as “transforming [the] core frameworks and processes for the engineering of cities including planning approaches and tools” (Tyler, Nick, Ortegon, n.d.). A shift in engineering practice would mean using processes that are not static (i.e. a one-off consultation, a public inquiry). Instead they would be dynamic processes (ongoing) that moves away from the static view of visioning and can build capacity as change occurs. As a constant process it is also constant in its inclusivity and through prioritization of these high level principles that shift away from how visioning is currently done.
The implications of this point of departure would mean that as it is not driven by the needs, wants and aspirations interests of the dominant group, it is open to views from among seemingly disparate stakeholder groups. Applying this point of departure moves beyond competing intermediate interests through a set of high level principles that is integrated at every step of design, planning and implementation.

Another implication of this typology is that it transforms the position of ‘visioning’ in engineering altogether. It positions visioning as a form of ‘engineering change’ in a city in a way that “promotes transformative action as the vision does not end with the definition of urban principles, it begins there” (Tyler and Nick, Ortegon, n.d.)

1.3 “Inclusion of a social justice oriented approach”: The Gender perspective

The gender perspective research group applies the designer-centered departure point because it aims to transform how the designer thinks about the process, knowledge and perspectives used which has implications for how decision-making is made, how design is taught and approaches used in practice. It is proposed in the text that achieves this through the inclusion of a gender lens in engineering practice and education (Cosgrave, n.d.).

The implications of applying this point of departure is that it proposes a transition from the current state of engineering education and professional practice to a more social justice oriented approach. This could take the form of a gender agenda that includes knowledge, capacity building and incentives to create more inclusive outcomes in engineering institutions. An application of this agenda might include for example “examining the lifecycle of an engineer’s academic and professional development as well as the lifecycle of
engineering projects in order to develop a knowledge base that from the beginning is designed to incorporate a gender lens” (Cosgrave, n.d.). The implications of including this point of departure is that it incorporates a gender lens that values women’s experiences which contributes towards a social justice oriented approach that can transform the role of engineering institutions.

1.4 “Highlighting blinds-pots within complex environments”: Choreographing the city

In this study, the researchers examine the differential mechanisms employed by engineers and choreographers to understand, notate (sketch, map or describe) an intervention for a public space such as a train station. Whilst still in the exploratory phase, the researchers have found emerging themes including: improvisation as a tool to simultaneously develop and refine ideas in real-time; ‘Thinking with the body’- whereas knowledge in engineering is developed through observation and communicated in written form, choreographers develop and communicate ideas by experiencing and inducing physical responses; and ‘qualitative notation’- whereas engineers have models to represent volumes and distribution of movement through the city, choreographic notation includes ways to describe the qualities of movement.

The implications of this insight is that by understanding the worldview of another discipline, and translating this to the engineering of cities, designers can highlight blind spots for addressing complex challenges where current approaches are insufficient to deal with complex aspects of urban design. If incorporated as a standard practice, this could contribute to new ways of thinking about engineering principles and practice.
The projects that originate from this point of departure have found that engineering futures must be: more socially oriented; process-focused and adopt radically different world views.

This point of departure places the starting point for transforming the engineering of cities with the principles and practice within engineering institutions and the processes that they engender. From these examples, there are also a set of actions that emerge in considering what “transformed” approaches described in this departure point are achieving. They are:

1. Placing social metrics alongside “green indicators
2. Moving away from the static view of visioning
3. Envisioning what engineering should achieve
4. Applying more social justice oriented approach
5. Understanding how different lenses and perspectives from other disciplines might highlight blind spots for addressing complex challenges.

These examples show the ways in which the principles and practice from the perspective of the designer have the potential to transform the agenda of engineering solutions. The next section will describe examples of projects where the departure point begins not with the designer, but with the urban form itself.

2. Re-imagining the function and form of the city (urban form)
Beginning with a city’s form and how it functions as the starting point for solving an urban problem introduces a different point of departure. This point of departure highlights a feature (a caricature) of the city where an alternative future (i.e. A car-free city) may be desired or explores an innovation existing feature (i.e. Smart cities) in order to draw attention to other sectors where it could benefit from added engagement (i.e. Transport and smart technology) or disruptions that that may underlie challenges in governance. In either of these cases, this point of departure provides a bird’s eye view of the end product, the urban form.

With a focus on the function and form of the city, this distinctly “product” focused approach involves the designer, but starts with the desired form or the outcome the city should deliver. If we understand a caricature as a feature that is exaggerated, it can be conceptualised beginning with that desired form or outcome (i.e. ‘Car-free’ or ‘smart’ city). If the outcome is a city without cars, a “car-free” design would be the desired form, or “caricature”, of the city that would guide future planning efforts. If the outcome is “smart”, that would be a desired outcome, or another “caricature” of the city that might help to align groups with a similar interest in smart cities. The usefulness of this approach is that it magnifies a feature to orient visioning towards a particular effort, draw together similar interest groups and promote an approach to analysis that highlights how and where a ‘caricature’ interacts with other elements of the city system.

This point of departure can include caricatures specific to a process in addition to an alternative form or an aspect of an existing form as discussed previously. A process can be flows (i.e. Energy) and/or metabolism (i.e. Waste pathways) within the city. This example
would provide a bird’s eye view of the city with particular attention to one or more features of a process and how it interacts with different aspects of the city. The result is a magnification of how this particular element interacts with the rest of the city system and therefore reveal its significance or role in greater detail. is that the outcome for the city is based on “a caricatures of a city” that makes a particular feature big to reveal thinking that would “turn the idea of how we understand the city if it was...”

Implications for of applying this point of departure

2.1 “Promoting a closer look”: Sharing city

In thinking about the ‘sharing economy’ as it exists currently within the city and the desired form or “product” so to speak, this study used using interactive tools such as local maps and interactive workshops to radically shift how city-dwellers participate in discussing their views of the sharing city and in how they would like to see it constructed. This included “1) the use of design orienting scenarios as a result of and to further social conversations about possible futures beginning with the desired form and function of the city and 2) mapping local actors to understand existing promising examples that transform what happens currently on a small, disconnected scale from what is detached from alternative visions of what the city for the future requires. (Pollastri, Serena, Boyko, Christopher, Clune, Stephen, Cooper, Rachel, Coulton, Claire, Dunn, n.d.)”

Applying this point of departure with the desired form of how the sharing city should be constructed may inform engineering practice by providing examples of scalable processes for co-creating the sharing city. Similar to the future visioning workshops, the experiences of
the stakeholders involved in the production of the sharing city provide insight on the importance of the participatory nature of city building.

2.2 “Leveraging mechanisms for governing cities in the digital age”: Delivering the Smart City

By examining the role of governance for smart cities, this project highlights the opportunities available now for tech innovators to leverage and navigate governance systems as well as a set of actions (i.e. taking ownership, clarifying opportunities) to guide local government in how they incorporate the changes in tech to meet their own agendas.

Findings from this study apply the departure point by highlighting an existing feature, a caricature, which is the smart city. By acknowledging that the “smart city is here”, “cities are spending” on the smart city, the findings suggest that in order to optimise the opportunities of the smart city, cities will have to begin with the existing form of the smart city and adapt. For cities of the future, “local authorities must develop a capability to plan strategically for urban innovation as well as respond to disruptive innovations as they hit the market” (Cosgrave & Doody, 2014). The point of departure here is in recognising the current state of the smart city where it is now and taking smart steps to govern in the digital age. The implications of the smart city as the point of departure is that it in theory, there is a requirement of local governments to accept the pace of change and to take ownership in crafting a vision for innovation in their cities. In practical terms this might for example suggest involve for example, investing in programmes for innovation in their cities, supporting city labs and smart city networks and supporting infrastructure for sharing data within the city. By drawing attention to a perspective on the form and function of the city, this point of departure suggests policy and investment direction will be a function of the existing form of the smart city and the vision for it in the future.
Highlighting processes in a city is another way in which the form and function of a city can be applied as a point of departure. Processes of ‘urban metabolism’ apply the urban form departure point by highlighting how cities work in terms of the resources that flow through it, the wastes they produce and structures needed to deliver them. By starting with how flows operate within the urban form, this study uses this point of departure to shed light on areas where more attention may be needed. Due to the complexity of these systems, there is added attention on the following to ensure conclusions based on studies of flows are robust: scale, networks, data availability, complexity, life cycle, internal flows (Lee & Bouch, 2016).

The implications of this departure point is that by narrowing a focus in order to confront the complexity surrounding flows in modern (ie. resource and waste) cities, there is detailed attention to one system but taking into consideration how it might affect and be affected by other systems. This shifts thinking from a sectoral, top-down approach to thinking to one that is wide and holistic while maintaining a focus on a specific process-related challenge facing cities. With a focus on resources or waste, this point of departure highlights how these flows interact with the social and economic aspects of the city. In this case, highlighting a feature like metabolism renders the complexity within the city more apparent by drawing attention to a series of approaches that deal with scale, networks, data, complexity, life cycle and internal flows in order to best design an urban form that is fit for purpose.
2.4 “Designs for finding identifying cracks in a city”: “car-free city”

Examples where a desired form of a city, such as the car-free city, are applied as the point of departure contribute to insights on a range of challenges (technological, economic, organisational and social) that would be needed to ‘engineer’ a post-car system. Even though there is not evidence of a complete car-free city, this “thought exercise” (of what it would take to have an urban form that is designed for other non-motorised modes) contributes to an understanding that there are “no silver bullets for energy in cities” (Urry, n.d.). What this point of departure provides in addition to a system design insights, this point of departure offers, is a map that ‘identifies cracks’ in the system; that if overcome or “cracked” can contribute to other car-free initiatives.

The implications of this point of departure would use thinking through the way the layout of a city for cars influences how people live, work and interact as a starting point towards crafting a vision for the city and how it would have to be designed to achieve that vision. This understanding would be needed for example, in order to alter energy consumption profiles towards decentralized electricity networks and local energy consumption which would be a context required for a car-free future. This understanding would also require understanding the functions of a city designed for cars in order to best facilitate a transition towards an interactive, citizen friendly, smart city whose functions are in line with that form.”

Applying the departure point of the urban form provides opportunities to highlight existing characteristics at a city level (i.e. in urban metabolism, sharing city, smart city), desired futures and barriers that need to be overcome to achieve them (car-free) and roadmaps for orienting
designs, processes and mechanisms for governance in order to achieve a vision for the urban form.

3. User-centered design

This typology begins first with the user and information communicated by the user on his/her needs that includes perspectives related to what is required to best meet those needs. This departs from traditional engineering practice which views people as nodes, shaped by their surroundings that can be categorized, rather than messy, complexities that have needs, wants and aspirations which shape and are shaped by surroundings.

Implications of applying this typology

3.1 “Human-centered approaches”: UK City-Dweller Aspirations for Cities

There were several findings from the study on aspirations of youth in cities that provide an evidence base for collective living and design. This study applies a departure point beginning with the user’s aspirations. For example, the evidence base for collective living and design is informed by a desire from users’ for spaces where connection is paramount (i.e. communal ways of living, spaces that are family-friendly and community-friendly). There was also evidence that was less expected such as desire for social connectedness and security in connection with a nostalgia for the past [Joffe, Helene and Zeeb, n.d.] [Office6]. The implications of findings related to this point of departure are that it leads to
recommendations that are informed by a human centered approach and thus can account for actions that combine carbon reduction initiatives and individual well-being.

Further implications of this point of departure is that in using city-dwellers’ aspirations iteratively aspirations iteratively in practice, it can contribute to planning that integrates personal well-being and aspirations as core engineering principles.

3.2 “Designing for well-being”: a comparative study of Birmingham, Lancaster and Southampton

This study on deprivation and density applied the user-centred point of departure by looking at how users perceive they are situated in an urban context. Findings that suggested that people living in high density/high deprivation perceived themselves as having fairly good mental health and optimism for the recent future in communities of people living high density/high deprivation areas despite perceiving their general health as being quite poor. Nonetheless, they exhibited dissatisfaction with the physical setting and safety afforded by their neighborhood [Rajendran, Lakshmi Priya, Boyko, n.d.] Office7. The implications of this applying this departure point is that it incorporates the experience of the users in areas of density and deprivation in understanding the relationship between wellbeing and low carbon initiatives in cities.

Other implications of these findings is that it can transform how interventions are prioritized in a planning context from a user-perspective. Applying this finding from this point of departure might inform planning by highlighting that people in neighborhoods that have high density/high deprivation are not necessarily the ones whose residents have the
lowest levels of well-being. Findings like this can direct investment towards areas that need it most. In this example, interventions may be directed towards safety and the physical setting rather than efforts to improve emotional well-being. More broadly, the implication of this point of departure is that it challenges engineers and planners to think about commonly faced problems such as environmental quality with the user’s perspective.

IV. Discussion

The three points of departure: designer, urban form and the user perspective provide different ways for thinking about transforming engineering practice. Each of these points of departure prioritize different concepts as the reference point though they likely incorporate aspects of the other points of departure: the principles and practice ‘designer’ approach prioritising application critique of engineering principles, placing the pivot for transforming practice with the designer. In these examples, that is the engineer. In the ‘urban form’ approach, the existing or desired form, function or process in the city is the starting point. This prioritizes an aspect as it relates to the end product that the city should deliver (i.e., A smart city, a sharing city, a car-free city). The third point of departure prioritizes the needs and wants of the user and places his/her needs, wants and aspirations (actual and/or perceived) at the center of the problem-solving process.

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<th>Designer</th>
<th>Urban Form</th>
<th>User</th>
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<tr>
<td>Placing social metrics alongside “green indicators”</td>
<td>Promoting a closer look</td>
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<td>Understanding how different lenses and perspectives from other disciplines might highlight</td>
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The ideal vision that emerges from considering each of these points of departure is that a transformed approach in engineering practice would involve altering core fundamental principles in engineering. This would suggest that techniques to understand ‘aspirations’ and ‘visioning’ would be a core component of a rigorous process in engineering. This would lead to a methodical way of investigating these aspects as standards in training and practice, with attention to the different stages in a design process where a particular point of departure is fit for purpose. The following section will discuss implications and strengths of applying these different three point of departure jointly and simultaneously.

1. Implications of each of these points of departure

A strength of the designer-centered point of departure is that it is likely to have a time horizon that is relatively long compared to the other departure points. The strength of this is that radical approaches to design may have profound impact on the way in which practitioners train and think about engineering problems. Similarly, with a long horizon, the opportunity to shift how we think about the process of problem-solving can also adapt. In the example of the future visioning workshops and breakfasts, if applied as a core component of engineering practice may improve how designers conduct a process of vision building together with a variety of stakeholders.

The implications of applying this departure point is that it has the opportunity to constructively critique engineering practice based on its past performance and lessons
learned while also suggesting that the metrics and processes for planning and evaluating are areas where key stakeholders can make adjustments. Places where this critique could transform practice could range from pedagogy and teaching, policy and advisory and in practice.

A strength of the urban form point of departure is that it is a space where innovations can be trialed and challenged in real time either through highlighting aspects of existing urban forms or conducting scenarios for alternative futures. As it is a departure point that recognizes that there are several possible ways to interpret features of a city (ie. Smart city, sharing city etc.). Using the example of a “smart city” that has green growth model, a departure point focusing on urban form could be one designed to be car-free, yet it could also be one designed for autonomous, electric vehicles.

The implications of the findings for this departure point is that if a particular form and function is taken into account without the relevant stakeholders, there may be innovation in one area of engineering (i.e. Car-free designs for cities and/or new methods for sharing in cities) that may hinder progress in another area. For example, a car-free designs that remove vehicles without a holistic approach to planning, may result in disrupted local economies and/or labour markets. Nonetheless, because the time horizon for these types of interventions can range from short-term to long-term, there are several opportunities to highlight one feature and monitor its perceived and actual impact and evaluate influence on other areas.
The strength of the user-centered point of departure is that with the user at the center there are several opportunities to engage in the process of designs and policy recommendations that are reflective of user’s perceived needs and wants. There is also greater likelihood of appropriation of the intervention by local communities. In the example of the UK City Dweller Aspirations’ study, a focus on the user led to results in recommendations for future planning based on the aspirations and stated concerns with how young people view their city. In this example, the user is one of several stakeholders to take into account.

The implications of applying this departure point is that it radically shifts the problem-solving away from the designer and towards solutions driven by and for the user. This also introduces the reality that solutions have to be dynamic and adapt to a reality where user’s needs and wants may change. The implications of this approach is that it also contributes to a recognition of the complexity, dynamism and ‘messiness’ of human and societal change with practice and design-making itself. While beyond the scope of this paper, this is discussed in the white papers as both a strength and a constraint.

2. **Opportunities for transformation; applying these departure points**

The implications of these different departure as a group is they together they highlight the possible opportunities to transform the engineering of cities and to promote societal well-being from three perspectives that are already being employed in crafting future efforts. What this paper aims to achieve is to emphasize the implications of recognizing these departure points and raise awareness of strengths of perspectives that may be overlooked due to conventions in engineering design and practice.
Considering the implications of each approach also highlights limitations for each one. The limitation for the designer focus are that it can replicate good practices that are based on sound evidence, yet may not be fit for purpose for a dynamic city and changing population. The limitations for an urban form focus are that without holistic input from the range of different stakeholders, it may not be fit-for-purpose for all groups, and in worse case scenarios, may prove disruptive. The limitations of the user focused approach is that without a holistic view of how different users interact with each other, the city as it is changing etc. it may not address the range of different users. In fact, it may perpetuate inequalities related to provision of services and/or resources designed for a particular user group. One may to mitigate a limitation of one point of departure by considering where the strengths of another point of departure. For example, a user-centered approach might help overcome barriers in a solution where an urban form point of departure is strongest (for example in ‘designing a car-free city’ including lessons from a user-centered point of departure).

Taking these limitations into account, there is a recognition of the strengths and implications discussed previously when one or more of these different departure points are taken into account. What happens when each of these departure points is incorporated at the starting block? To some extent, each of these projects include input from each of these themes, but what would a project look like when each of these departure points are used at the stage of understanding the problem?
The project that looked at designing for well-being in Lancaster, Birmingham in Southampton (insert cross-reference) may be achieved by understanding how users from areas with varying levels of deprivation and environmental sustainability perceived their well-being. The concept behind this approach is that from a design perspective, it should be designed with these core components at the center (3.2 “Designing for well-being”: a comparative study of Birmingham, Lancaster and Southampton “Designing for well-being”: a comparative study of Birmingham, Lancaster and Southampton).

VII. Conclusions and recommendations

In analyzing interventions designed to transform the engineering of cities for societal and planetary well-being yielded a typology and a process for recognizing points of departure that as part of future practice in engineering, can better inform the process for designing a solution. The examples from the Liveable Cities’ [Office9] project programme demonstrate that there are differences in points of departure of the different projects, which invariably, may reflect differences in how problems are approached and understood. While beyond the scope of this paper, it is likely that the differences in outcomes will vary based on the point of departure applied, though there may be other contextual factors to consider in that type of analysis.

These departure points operate with implications that may be more profound over the long-term (i.e. Principles and practice for engineering) or short-term (user-centered interventions) and require different processes for engaging with a range of different stakeholders depending on the nature of the problem they are looking to solve. Taking these into account requires an
awareness and understanding of which point of departure features most prominently and using that as a baseline for assessing strengths, limitations and what features of other departure points may be applied to inform a project approach.
References [white papers – primary data]


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