

An Applied Mereology of the City: Unifying Science and Philosophy for Urban Planning

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Received: 28 June 2015 / Accepted: 12 August 2015
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Abstract Based on their research showing that growing cities follow basic principles, two theoretical physicists, Luis Bettencourt and Geoffrey West, call for researchers and professionals to contribute to a grand theory of urban sustainability. In their research, they develop a ‘science of the city’ to help urban planners address problems that arise from population increases. Although they provide valuable insights for understanding urban sustainability issues, they do not give planners a manageable way to approach such problems. I argue that developing an applied mereology to understand the concept of ‘city identity’ gives planners a theoretical device for addressing urban affairs, including ethical concerns. In turn, I devise a model of city identity to show how a ‘philosophy of the city’ contributes to a grand theory of urban sustainability.

Keywords Applied mereology · Urban planning · Environmental justice · Participatory engagement · Philosophy of the city

Introduction

Through analyzing data sets covering over one hundred cities, a team of researchers found general principles that belong to most cities (Bettencourt et al. 2007). If we consider that knowing such principles is a prerequisite for understanding the identity of a city, their discovery sharpens our conceptualization of the built environment. Based on their findings, recognizable patterns that correlate with the underlying structure of a city’s identity also include problems that arise when urban centers increase in population. Often, such problems involve social and environmental

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injustice issues (Powell 2009; Colette 2010). In these instances, we must think about such issues as part of a city's identity. Urban planners can use the concept of city identity as a theoretical device for mitigating harm that such issues cause, and they can employ participatory approaches to help remove injustice from a city's identity. Considering the global scale of such problems, this device counts as a humble addition to the necessary measures required for a just, sustainable planet.

Noting the challenges facing the world's cities, Bettencourt and West (2010, 912) call for academics and urban practitioners to make interdisciplinary and trans-disciplinary contributions to a "grand unified theory of sustainability with cities and urbanization at its core." Academics employing Bettencourt and West's research show how to make such contributions. For example, Jabareen (2013) uses their research to develop new frameworks for strategizing against climate change and environmental risk. Noulas et al. (2012) rely on their work to understand the nature of urban transportation, and Sassen and Dotan (2011) seek to understand multi-scalar and ecological conditions of cities to address urban relationships with the biosphere.

Philosophers can help overcome some of the epistemological limits involved in such a grand theory. For instance, Bettencourt et al. (2007) and Bettencourt and West (2010) give us grand-scale guiding principles about urban growth, but they do not provide a practical way to employ this knowledge, rendering it nearly useless to the non-specialist. Through using an applied, informal mereology, urban practitioners gain a means of using Bettencourt and West's insights to solve specific planning problems, contributing to a grand theory of sustainability on a local level.

Mereology is a study of a theory concerned with the relationship of parts to parts and parts to wholes (Varzi 2015). Applying mereological concepts lets us make sense of objects that are composed of smaller parts or have overlapping parts (Paul 2002). Through applying this basic structure, we can account for how the parts of a city fit together to form a complete city. Holding that a city's identity equals the totality of its parts, along with time and the interchangeability of parts, provides common ground for conversations about the identities of cities. Such conversations are necessary because they exhibit the kind of cities that exist and the different social and environmental issues that arise in part-to-part and part-to-whole relationships.

In this paper, I provide an overview of Bettencourt and West's research and explain the basic idea behind applied mereology. I use its principles to categorize the parts of a city. My goal is to provide an informal mereological model of city identity that shows how the parts of a city relate to each other and to the city as a whole. The specific purpose of this model is to demonstrate how different kinds of ethical conflicts arise from a lack of congruence between a city's parts. In turn, we see how the concept of a city's identity works as a theoretical device for approaching social and environmental justice issues on the job. Lastly, the paper concludes with some recommendations for future areas of research for academics and highlights how recent 'real-world' projects show promise for similar measures that are required for a grand theory of urban sustainability.

The Benefits of a Science of the City

Bettencourt et al. (2007) and Bettencourt and West (2010) exhibit that most growing cities follow a set of basic principles, allowing for a significant degree of predictability. Despite political, economic, or social considerations, they hold that cities essentially follow a pattern of growth (*ibid.*). One key point from their study shows that doubling the population of a given city only requires about an 85 % increase in infrastructure, including elements such as roadways and water services (*ibid.*). From this finding, Bettencourt and West (*ibid.*) show that high-density urban centers are more efficient than smaller cities when it comes to resource consumption. Spatially, large cities, by default, increase the environmental aspect of their sustainability status.

Although there remains much variation between cities, Bettencourt and West (*ibid.*) conclude that as a their populations expand, the amount of space required for living decreases, economic activities rise, and new forms of cultural expression emerge. As a city grows, positive aspects such as educational opportunities along with wages and GDP increase by approximately 15 % more than the expected linear growth, but so do crime, traffic, and public health issues (*ibid.*). While it is rather difficult to improve cities that already have a seemingly insurmountable number of problems, cities that find success achieve a status of resiliency that lasts for decades (*ibid.*).

While urban practitioners can use a science of the city for predicting the general kinds of problems that they might encounter, such a practice reveals little about how to approach such conditions in a manner that benefits specific cities or detailed problems. Their science rests on quantitative analysis, giving us a categorical description of urban centers, but each city is identical only to itself, and this notion holds for each city's problems. One cannot assume that the causes of a problem in City A are the exact same causes of the same kind of problem in City B. In turn, a good way to complement Bettencourt et al. (2007) research is to directly analyze urban problems in their contextual settings, an undertaking that requires demarcations of scale that a model of city identity makes evident.

Such a model shows how a city's numerous seemingly incongruous parts function as a unit, as a city. Studying the parts of a city as they relate to other parts and how they relate to the city as an object counts as a mereological exercise. Within the mereology literature, however, philosophers engaged in classical mereology research mainly deal with part relations in a highly abstract and formal fashion (Hovda 2009). Recently, philosophers and theorists have shown how the tenets of mereology have interdisciplinary appeals for the sciences, along with applicable uses for computer science and engineering (Claudio and Graziani 2014). Consider, for instance, that Jansen and Schulz (2014) maintain that mereological approaches benefit descriptions of biological organisms, pointing out that mereology receives attention in biology and medicine. Polkowski (2014) shows that mereology has several applications for computer science, such as spatial reasoning and knowledge engineering.

Other researchers, however, stray from a formal grounding to gain insights into additional issues, making their subjects accessible to a wider audience. For example, de Vignemont et al. (2005) employ an informal, applied mereology to examine how we experience body parts versus how we experience the body. They completely abandon formal methodology, approaching their study in a straightforward manner. In terms of treating the city as an object, an applied and informal approach retains the usefulness of mereology and makes the subject easier for non-specialists to grasp.

Stemming from mereology, strong composition as identity is a thesis about what counts as an identity in the relationship of parts to wholes, maintaining that an object's identity is all of the parts together, and nothing more (Cotnoir 2014). While there are different versions of such theories, the variety that works well for understanding the city is dynamic composition of identity theory. Put briefly, it holds that the identity of a city is all of the parts that a city has at any given time and how those parts fit and work together, bearing in mind that the parts continuously change. Considering that a city continuously changes its composition throughout time, through adding or subtracting parts, describing its composition as dynamic seems fitting. Although such a theory faces other challenges within metaphysics that are beyond the scope of this paper, for dealing with urban issues, the drawback for this position is figuring out the different kinds of parts and how those parts influence each other and the city.¹ In the following section, the focus will be on this challenge.

An Applied Mereology of the City

A city has several different kinds of parts. For example, each city has a history, and each part of its history counts as a part. Cities have weather conditions such as temperature, humidity, and precipitation, each counting as a unique part. Topographical characteristics are other parts. Of course, there are the kinds of parts that are familiar to us: buildings, cafes, bars, people, roads, building codes, and zoning ordinances. Zeroing in on such parts tells us a lot about the identities of cities. Yet, how are we to think about parts of city that do not come from the city, such as interstate highways or federal laws? Such things count as parts of the city, but counting them means that we must be able to differentiate between the parts.

While listing all of the different kinds of parts is an exhaustive exercise, categorizing the parts relevant to public works is a reasonable task. For such an enterprise, classifying parts as micro and macro is a good starting point. Most things in the city are micro parts. A person counts as a micro part, along with a stretch of sidewalk or a coffee shop. Such parts play a minor role in the overarching narrative of a city's identity. There are numerous kinds of parts to which we can assign labels

¹ My claims about city identity entail that a city only has one identity, but due to the social and political conditions that govern how people come to know a city's identity, people will describe the same city in several different ways. This topic, along with the kind of pluralism that Iris Marion Young exposed, presents challenges for a model of city identity. However, properly addressing such challenges is beyond the scope of this paper. For more information, see: Young (1990). *Justice and the Politics of Difference*. Princeton, NJ: Princeton University Press.

that help us understand how they differ. For example, most physical-public micro parts are the individual things that people pay for through taxes: a traffic light, a fire hydrant, a municipal courthouse, a police car, or bus. Such parts are “public” in the sense that the public “owns” them—at least this is so in most democracies. A nonphysical-public micro part is an individual thing such as a policy, a zoning ordinance, a fire code, or a specific law. Contrary to physical and nonphysical-public micro parts, a physical-private micro part is one that a person owns such as a car, house, or business, while a homeowners’ association guideline would be a nonphysical-private micro part.

A *macro* part is a set of micro parts. The primary difference between them rests on scale. Similar to micro parts, there are physical and nonphysical, public and private categories. Physical-public examples include a police force, a transit system, or a wastewater system. Physical-private parts include things such as a shopping center or a neighborhood. Nonphysical-public macro parts cover a set of municipal laws, building codes, or tax codes, while a set of neighborhood association guidelines count as a nonphysical-private macro part.

Micro and macro parts can be internal or external. The parts listed above are internal. Internal parts rely on the city as the primary entity wherein they gain their identity through their functioning within the city. The Brooklyn Bridge belongs to New York City because it facilitates travel from Manhattan to Brooklyn. An external part functions primarily for the sake of an entity outside of the city, such as a nation, a state, another city, or a business, even though they have a function within the city. They can be public or private, physical and nonphysical. Examples of external micro parts include a national post office, a national chain retailer, a grocery franchise, or an international treaty or law. The national post office system counts as an external macro part. They “belong” to the city in the sense that they express an operational function within it. In the US, for instance, most cities have federally funded interstate highways. Their origins are national, not municipal, and they have a national identity that precedes their local identity. Yet, they are parts of cities.²

Thinking About the Parts Together: The Role of Meta-structures

While the classifications above show how parts differ, we lack an account of how they interact with each other. To account for the degree of congruence between a city’s parts, employing the use of a theoretical device called a meta-structure shows how well various parts do or do not work as a unit. A meta-structure is all of the present micro and macro parts involved in a city’s operational structure. The benefit of this device is that it provides a panorama of how well a city is put together; how well it functions.

² This account of a city’s parts is not exhaustive. There are other issues that deal with boundaries, smaller parts that compose larger parts, overlapping parts, and so on. The point here is to illustrate how the basic structure of mereology provides planners with an alternative approach for thinking about how a city fits together.

For instance, there are almost an infinite number of parts interacting at any given time in a city. Residents rely on businesses for goods and services. Retailers use regulations, laws, infrastructure, and banks to facilitate trade. Religious organizations use transportation infrastructure to bring in members. If the micro and macro parts work together without too many serious failures, then the city's meta-structure is strong.³ The challenging aspect is establishing criteria for what counts as a failure. Campbell (1996, 2013), for instance, points out numerous conceptual and practical issues that we could interpret as failures in planning relating to sustainability and social justice issues. Such issues are contentious topics. While laying out precise criteria would be helpful in this regard, doing so is beyond the present scope of this inquiry. The example below, however, illustrates the necessary points without too much distraction.

For instance, if a city's physical-public macro part (for instance, the Department of Water and Power) works well with a nonphysical-public macro part (set of laws) to deal with a physical-private macro part (powerful neighborhood association) without experiencing a failure (environmental or social injustice, extreme pollution, etc.), then this indicates that the city has a strong meta-structure. If it consistently fails, then one could argue that the meta-structure is weak. To reiterate, arguing that a meta-structure is weak depends on establishing criteria for what counts as a failure. One could assume that indicators of failure would include environmental or social injustice, abnormally high rates of inefficiency, harmful levels of pollution, excessive waste, or detriments to public health. Such failures suggest that a city is not functioning in a manner that supports topics such as human flourishing, sustainability, or justice.

Consider, for example, if an industrial center such as a copper smelting plant works well with city ordinances and international policy, but it harms public health. As a part of the city, the plant weakens the city's meta-structure. Such blight becomes part of the city's identity. One could object to this point, arguing that a copper smelting plant could strengthen a city's meta-structure in other ways. For instance, through gaining needed revenue from the plant, the city could repair infrastructure, build new parks, or implement social services, increasing the degree of congruency between a city's parts.

Considering the total number of parts of a city, one harmful industry might not have a significant effect. One problem is that there is a high degree of complexity involved in such cases, making the evaluation of a meta-structure a complicated task. Despite such challenges, one could argue that interdisciplinary researchers could develop protocols for making such assessments. Although such a task is beyond the purview of this paper, developing such protocols could provide a systematic way to change a city's identity.

While changing a city's identity might sound alarming to some people, most changes to a city's identity are harmless. At the lowest level of identity change,

³ One might think that a high frequency of successful exchanges between parts shows that a city has a strong meta-structure. While this point is worth examining, frequency becomes irrelevant in the face of certain failures. Consider, for example, if a bridge were to collapse. The frequency of successful exchange involving the bridge could be in the millions, yet one failure could significantly impact several other parts, weakening the meta-structure.

losing or gaining a micro part counts as a minor alteration to a city's identity. This condition makes a dynamic composition as identity theory work well for built environments. If a city remains in perpetual flux due to constantly changing parts over time, and we say that a city is equal to its parts and how they work together, then a city has a special kind of dynamic identity, unlike most other objects. For instance, think about the opening or closing of a restaurant. Few people experience or notice such changes. The loss of a macro part is less common, compared to micro parts. When such changes happen, most people are aware, but the city retains much of its identity. For instance, the identity markedly shifts if a ballpark closes due to a team's relocation. Residents might value the ballpark as a landmark building or public space, giving the city a strong marker of identity, but the residents will adjust and the city will endure.

Despite the idea that a city's identity constantly changes, meta-structures mostly remain stable. Even though parts constantly change, the city continues to function as a unit. Cases wherein they completely lose their identity require a significant change in the number or arrangement of micro and macro parts. Natural phenomena such as a tornado or an earthquake could instantly affect a meta-structure. Hurricane Katrina's impact on New Orleans is an example of a meta-structural shift, showing how nature can play a significant role in a city's identity. Hurricane Katrina disrupted most parts, altering the meta-structure. During the rebuilding process, new or repaired parts gradually changed the city. When the rebuilding is finished, "new" New Orleans will resemble "old" New Orleans, but it will not be the exact same.

Such cases are concerning, but attention should rest on two other causes of meta-structural change. The first sort involves several macro parts simultaneously changing. For instance, when the Russians took control of Berlin, its identity drastically changed, due to an immediate shift in several parts. The Russians replaced or eliminated numerous parts such as laws, police force, and social services. Within a short duration, the city's identity ceased to exist, and East Berlin and West Berlin emerged. Instances such as this one should be areas of concern because they could involve human rights or justice issues.

The second kind concerns micro parts. Sufficient changes to micro parts bring on changes in macro parts, creating a different meta-structure. For example, imagine Las Vegas, Nevada without the legal right to gamble. The city, as we know it, would cease to exist. Most businesses, numerous jobs, neighborhoods, and infrastructure depend on the legal right to gamble. If one were to take away this micro part, the degree of incongruence would significantly increase because commerce, infrastructure, and people's livelihoods rest on this "cornerstone" micro part. These parts are not congruent without the law that permits gambling. In turn, eliminating this law in Las Vegas would create a weak meta-structure for the city. One could argue that the city might collapse.

While this hypothetical example caricatures the impact of a nonphysical-public micro part, it illustrates the power that one can have. Considering that such instances can drastically alter a city's identity means that they should receive additional study. What is more, other cases involving micro parts illustrate an aggregate power that can alter a city's identity in a gradual manner. Consider, for example, a city with only 'mom-and-pop' restaurants, a city known for its culinary

flair. If a multinational conglomerate were to steadily buy and replace each restaurant with chain eateries, the identity of the city would eventually completely change. The city would become one lacking original culinary style, a city that Relph (1976) would characterize as having *placelessness*. The point here is not to rally against franchises, but to show that a city's total identity can change piecemeal.

To make cities better places for everyone to live, to move them toward a just identity, municipal officials can amend “broken” parts, add new ones, or eliminate parts to ensure justice. Urban practitioners can improve cities one part at a time, eventually giving residents a sustainable, just city that provides them with the means to flourish. Changing a city's identity through this piecemeal approach could take years, but one could argue that it serves as a practical guide for improving cities, promoting social cohesion, and removing elements that harm vulnerable populations. Although listing the injustices that can affect a city is exhaustive, three examples below exhibit some common types of harm, and they illustrate how municipal workers can lessen their effects. What is more, these examples show how planners can use a model of city identity to map problems, showing the extent that harmful parts can cause injustice.

Using a Model of City Identity in Practice: Two Case Studies

The first case addresses the notion that cities must contend with chain retailers (external micro parts) moving into neighborhoods (internal macro parts) that cause a lack of congruence. Not all such cases lack congruence, but the instances that do lack it show how such occurrences weaken a city's meta-structure. For example, chain retailers often stand accused of homogenizing culture, which Ritzer (2009) calls the McDonaldization of society. The problem here is not that external parts such as chain retailers are inherently bad, but they raise justice concerns if their activities or presence harms residents, lessening the meta-structure's degree of congruence.⁴ If residents want an international franchise in their neighborhood, arguing against their desires would be paternalistic as well as disrespectful of community autonomy. Some cities or communities might prefer the predictability that comes with chain stores and franchises, perhaps favoring a blend of local and global commerce. Cases could exist wherein residents desire the global connection to a brand name or product. Issues confronting exploitation of people or ecosystems remains a separate matter apart from global connectivity and trade.

The point is that there are fewer concerns about justice if community members are included in the decisions that affect them (Figueroa 2006). For instance, according to Figueroa (2006), we would be dealing with an environmental injustice when organizations exclude communities with little or no power from decisions about policies that affect them. For example, although several residents in Portland, Oregon hold sustainability as a value, not all resident equally share this view

⁴ It is worth pointing out that congruence does not necessarily entail justice. For example, in certain societies, there can be a high degree of congruence between parts, but there is also injustice. This reason is why I focused on failures in the previous section. Injustice counts as a failure, a condition that could nullify appeals to congruence.

(Sullivan 2014). Some residents championed the opening of a grocery store in the Alberta neighborhood of Portland, claiming that it provided relief to a food desert and supported sustainability; however, the plan backfired (Sullivan 2014). Instead of securing food access for long-term residents, incoming whites gained a ‘mind–body lifestyle’ food outlet (Sullivan 2014). Some time later, history was about to repeat, but local residents voiced their concerns. This time, they were included in the conversation about permitting niche food retailer, Trader Joes into the community (Theen 2014). Due to residents’ fear of additional negative neighborhood impacts, Trader Joes backed out of plans to open a store (Theen 2014).

In such cases, there is a lesson for urban planners dealing with social justice issues. Urban planners with good intentions can identify the missing micro part causing a harmful situation. They can remove impediments and work with other municipal leaders and communities to arrive at a solution. A solution including the residents’ specific interests would have successfully linked residents’ needs with a retailer’s goods. For the Alberta residents, direct community representation alleviates the unjust conditions. Including this participatory dimension counts as adding the people, as a macro part, into planning decisions. In turn, planners strengthen the city’s meta-structure and work toward creating a just city wherein residents can flourish.

While the example above concerns an external part having negative effects for vulnerable populations, internal parts also cause harm. Consider, for instance, the hardships that minority residents in Portland endure due to the implementation of sustainable mass transit. For example, African Americans residing in the Alberta neighborhood were not only fighting against the effects of a mind–body lifestyle store as discussed earlier, but also they were struggling with urban renewal policies, forcing several renters from their homes due to rent increases that they could not afford (Scott 2012). To make matters worse, a second displacement followed the previous case mentioned above due to the implementation and expansion of Portland’s light rail system (Scott 2012). The Portland Development Commission (PDC) sought to lessen the harmful effects through tax revenue policies, yet activists against taxes took PDC to court, toppling 18 anti-displacement measures (Scott 2012). Today, some of the African American churches in the Alberta neighborhood remain, bussing the congregation in from the suburbs (Scott 2012).

While the Alberta case had an unfortunate outcome for Portland, residents of Cully Street worked with the City of Portland to fight gentrification to ensure affordable housing with appropriate zoning measures (Jackson 2012; Parks 2014). In 2012, Sam Adams, Portland’s mayor, and the PDC drafted the Neighborhood Prosperity Initiative, aiming to prevent displacement (Parks 2014). Along with city officials, neighborhood alliance groups and Portland State University students worked together to implement preventative measures that would keep housing costs from rising (Parks 2014). One could argue that Adams and the PDC, through including neighborhood groups in the conversation about such policy decisions, acted in a just manner. This conglomeration of parts was congruent, giving the city a stronger meta-structure.

For instance, the PDC (a physical-public macro part) along with the mayor, (a “cornerstone” physical-public micro part), in conjunction with the community

alliance (physical-private macro part), worked with zoning ordinances (nonphysical-public micro parts) to secure the conditions for residents to flourish. In turn, the consequences of the case in the Alberta neighborhood did not repeat. Although the effects of such measures remain in progress, if the concerted effort succeeds, Portland's municipal leaders working to prevent displacement will have a successful model to follow. Future planners in other cities will gain a guide wherein they can assess parts' effectiveness, determining which ones are problematic, beneficial, or perhaps have an untapped strength. When planners act in such a manner, they, along with residents, redefine their city's identity, working toward making a just, sustainable city.

The Role of Residents' Participation in City Identity

In the examples above, bringing the residents into the conversations about the decisions that had direct consequences for them improved the situations. Such actions in turn gave residents a role in defining the identity of their city. This notion exhibits how the concept of city identity remains co-extensive with the right-to-the-city literature rooted in Henri Lefebvre, expanded by David Harvey and critical geographers such as Neil Smith (Lefebvre 2000; Harvey 2008; Smith 1986).

Although Harvey does not directly engage with the term "city identity" as a conceptual device, he (2008, 23), holds that, "[t]he freedom to make and remake our cities and ourselves is, I want to argue, one of the most precious yet most neglected of our human rights." In this passage, he touches on the key ingredient either found or missing from the cases above: participation. In the previous examples, one could argue that if the communities would have been involved in the decision-making process, then charges of injustice would not hold much weight, according to various models of justice such as Figueroa's environmental justice paradigm (2006). If we apply Harvey's point to the Cully Street Plan, it indicates a step toward just urban planning, considering how such measures alleviate some of the harm from forces such as gentrification, urban renewal, or the implementation of sustainable mass transit systems.

Although Smith (1986) only implicitly deals with city identity in his gentrification research, he points out that those who financially benefit from gentrification are the ones who give the city several characteristics of its identity. In such situations, city identity is inherently a justice issue, considering that processes such as gentrification deny marginalized groups the ability to determine the city's identity. One could argue that practitioners who dismiss justice concerns within sustainable planning means that they would unintentionally side with injustice, considering that such actions do nothing to mitigate harm. In such contexts, city identity is a device that provides urban practitioners with an opportunity to lessen the degree of injustice in their cities.

While such arguments will resonate with practitioners supporting Susan S. Fainstein's view that justice should be the primary driver of planning initiatives and a significant metric for measuring the success of planning outcomes, it is challenging to completely dismiss justice issues in sustainable planning, considering

that the social pillar of sustainability entails justice (Fainstein 2010). Engaging in such practices secures the preconditions for planning in a manner that remakes a city's identity in a just fashion. For instance, if urban planners, engineers, or architects engage in successful projects that make their cities just, then we can label such parts as just, increasing the total amount of justice in a city's identity. One could argue that if all of a city's parts were just, then it might not be a complete mistake to call the city just.

Considering that the ratio of just parts to unjust ones would be higher in select cities, some cities would be more just than other cities. Thereby, a person could claim that City A is more just than City B, based on the ratio of just to unjust parts. One could also make other justice claims through comparison, saying that City C is much more just than City D. Although complications ranging from lacking an accepted conception of justice to nonexistent protocols for implementing measures rooted in such a conception riddle this line of inquiry, it suggests that establishing criteria for what counts as a just city is possible. Due to its usefulness for accounting for injustice (along with other failures) as incongruences between a city's parts, a model of city identity that contributes to a grand theory of urban sustainability is part of the solution to the challenges facing the world's urban centers.

One could object to the points above, holding that a case for using a total accumulation of justice is imprecise, impractical, unverifiable, untestable, and that unscrupulous city officials could manipulate the numbers to increase commerce. Such charges would be fair, but such claims do not appear thus far, and such objections misunderstand the point of creating and using a model of city identity. The aim of employing this model is to achieve a better state of affairs for a given city, to increase the likelihood that all residents can flourish, especially when dealing elements such as rapid urbanization and urban renewal. What is more, holding such an objection suggests that a precise system of measuring justice is an option. It seems far-fetched to think that developing one remains possible, considering that we cannot measure justice with pinpoint accuracy. Despite lacking an accurate metric for quantifying the exact amount of justice within a city, a rough estimate provides urban practitioners with a means to address failures that result from a lack of congruency between a city's parts.

Future Directions

While Fainstein (2010) holds that justice should be a prime motivator for planning, she expresses mixed sentiments about participatory approaches as indispensable vehicles for justice. Although her views were fair at the time when she penned them, since then, experiments such as the Participatory Budgeting Project (2015) exhibit how such measures deserve more credit due to their effectiveness. Participatory budgeting (PB), for example, is a practice wherein city council members provide funds to community groups for public projects (Menser 2012). Since 2009, the Participatory Budgeting Project (2015) has connected 35 elected officials with over forty thousand constituents in the US, engaging in over two hundred projects amounting to over 45 million dollars.

Within a model of city identity, PB, as a part of the city, increases the congruency between several of a city's interacting parts. For instance, community groups (physical-private macro parts) work with public funds (physical-public micro parts) to implement projects such as bike lanes, community gardens, streetlights, and playgrounds (physical-public micro parts) (Participatory Budgeting Project 2015). Menser and Robinson (2008, 294) explain:

[PB] is characterized by several basic features: community members determine spending priorities and elect budget delegates to represent their neighborhoods, budget delegates transform community priorities into concrete project proposals, public employees facilitate and provide technical assistance, community members vote on which projects to fund, and the public authority implements the projects. Various studies have suggested that participatory budgeting can lead to more equitable public spending, higher quality of life, increased satisfaction of basic needs, greater government transparency and accountability, increased levels of public participation (especially by marginalized residents), and democratic and citizenship learning.

From this passage, one could argue that PB makes other parts function in manner that avoids injustice and promotes human flourishing. In turn, the parts remain congruent. Such empirically verifiable case studies exhibit that participatory approaches give residents the ability to play an active role in defining their city's identity. While there is no guarantee that other kinds of participatory approaches will have the success of PB, one could argue that research into participatory approaches such as planning advances studies of how to make it successful.

For example, Umemoto (2001) addresses issues such as the epistemological shortcomings of participatory planning while Pugh (2003) identifies practical complications and justice challenges. Others research areas show how science and technology improve the conditions for participatory planning. For instance, Khan et al. (2014) exhibits the usefulness of information and communication technology devices for participatory urban planning and urban management, and Livengood and Kunte (2012) show how GIS technology bolsters participatory planning efforts. While such advances suggest that improvements to participatory planning are possible, additional research is required to discover how participatory approaches improve congruency between a city's parts and reduce injustice.

Concluding Thoughts

When Bettencourt and West (2010, 912) championed a grand unified theory of urban sustainability, they called for a "major international commitment and dedicated transdisciplinary collaboration across science, economics and technology, including business leaders and practitioners, such as planners and designers." Such a call requires significant efforts that might not be possible without their initial contribution described during the introduction, a science of the city.

A science of the city gives researchers and practitioners reliable evidence about the state of cities, yielding predictive measures for combating problems that

typically come with population increases. While such information exhibits the benefits of science for urban centers, it also reveals the limits: science cannot provide normative direction for decisions in urban planning. As science is knowledge and the latter is vital for urban planning. It is also necessary to determine the rules and regulations of conduct. We do not set out rules of conduct de novo or ex nihilo. Going beyond these limits means acting on the knowledge that scientists make available, actions that subject actors to moral scrutiny. Although we do not usually think about planning measures as opportunities for gauging morality and justice, select cases such as those in this paper reveal how planning decisions have such normative dimensions. Philosophers of the city can complement the work of scientists through revealing a city's identity via mereology, providing a way to approach cities in a manageable fashion that takes a determination of their relationship with justice. One problem is that philosophers cannot interact with planners and municipalities during decision-making moments. Yet, such dialogues could have benefits for residents.

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