Retro-*'fitbit'*ing the Built Environment: Evaluating the pace of urban, suburban and rural conditions

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The 20th century taxonomy of human settlement conditions – the urban, the suburban and the rural – is no longer so clear, especially in the 21st century. The lines between urbanity, the suburbs, and the rural are becoming blurred. This blurring of previously clear divides is a function of various factors – economics, ecology, climate, convenience, physical resources, perception, cultural diversity, etc. – that directly or tangentially influence human occupation and the shaping of the human experience within the built environment.

Today, development within urban and suburban areas continues to grow within the US, paralleling global trends with populations shifting to urbanized areas. Despite the shifting urban population, the physical health of our urbanized environments and communities – the ecological, infrastructural, economic and social well-being – continues to be heading towards recovery. The metrics often used for evaluating the physical health of one urban environment in relationship to another are reflected on a livability index. While the quantity of evaluation criteria for such livability indexes vary from one index to another, it is clear that evaluation criteria are amenity-based metrics, measured on proximity and accessibility to urban amenities in lieu of actual performance-based metrics. If, then, performance-based metrics, such as real-time health metrics, were to be utilized as evaluation criteria for rating the livability of an urban environment, how might we read and analyze urban environments upon the lifestyle an urban system promotes and its direct impact on the physical health of its residents?

TIPPING THE SCALES

> *"The world has urbanized rapidly since 1950 and projections indicate that it will continue to urbanize in the coming decades. In 1950 the world was mostly rural: more than two-thirds of people lived in rural settlements and less than one-third in urban settlements. In 2014 just over half of the global population was urban. This distribution is expected to shift further towards urban areas over the next 35 years so that, by 2050, the world's population will be one-third rural and two-thirds urban, roughly the reverse of the situation in the mid-twentieth century.*[1]
>
> -United Nations (2014 Rev.) World Urbanization Prospects

The scales have tipped – the rural settlement condition, predominantly rooted in agriculture production in service of sustaining the world's population, is no longer providing the social and economic needs (and interests) for its residents. Our increasingly global economy, a generator for new education, business and employment opportunities within cities and across country borders, has provided great influence in attracting generations out of their rural settlements and into a variety of new urbanization models – ranging from small urban agglomerates to megacities. Similar to the global trend of shifting populations towards urbanized settlements, the American landscape has also been impacted from this population tipping point, experiencing continued development and expansion of its suburban landscape and a re-focused effort of revitalizing its urban cores. This shifting population movement has re-pressurized some of the once productive, industrial-rich urban landscapes of the twentieth century, healing their post-industrial scars through transformation into hip live-work-play environments for millennials, young families, empty-nesters, and even seniors. Likewise, today's post-war suburbs are also feeling the stress - increasing commuter times, rising land and real estate values, and aging housing stock have contributed to suburban sprawl and/or have significantly adjusted the expectations of the new twenty-first century suburban lifestyle.

In fact, it could be argued that the twentieth century taxonomy of human settlement conditions – the urban, the suburban and the rural – is no longer so clearly defined, especially in the twenty-first

century. The lines between urbanity, its surrounding suburbs, and their shared rural backgrounds are becoming physically blurred. This blurring of once previously clear divides is a function of multiple factors that carry with them varying weights of influence – i.e. economics, ecology, technology, policy, climate, convenience, physical resources, perception, historic significance, cultural diversity, etc. – that directly or tangentially influence human occupation and mediate our human experience and interaction with the built environment. While there is a concerted effort (mostly through policy and planning exercises) to remediate the impact that these man-made and natural forces may have on the future shaping of our urban landscape, often, the effort is reactive and attempts to resolve an issue or concern at the local scale, not the systemic one. Thus, our blurred urban landscape comes into vision - residential developments, big box retail, corporate headquarters, strip malls infiltrate once urban, industrial wastelands while small office towers, boutique retail, and public transit invade the bedroom communities of the sub-urban landscape. The consequent effects of this dynamic process of urban assemblage– patched, layered, exchanged and evolving with new history over time - are not fully legible or understood from the perspective of its user(s). But, maybe more importantly, the effect that this blurred amalgamation of urban fragments has on the imprint of one's physical (and mental) health has not been fully understood - or properly evaluated.

EVALUATING URBAN 'LIVABILITY'

Despite the physical burdens that a burgeoning population and resurgence in urbanization place on existing urban systems, the overall health of our urbanized environments and communities – the relationship between ecological, infrastructural, economic and social well-being – is on the mend and heading towards a *fuller* recovery. The metrics that are often used for evaluating the physical health of one urban environment in comparison to another are often reflected on a *livability index*. While the quantity and diversity of evaluation criteria for such livability indexes vary from one agency to another, it is clear that evaluation criteria, across the board, are dominantly amenity-based metrics, measured on proximity and accessibility to urban amenities (i.e. healthcare, affordable housing, public transit, recreation outlets, etc.). The more accessible, available, and proximate amenities are in relationship to a city, district, or neighborhood, the higher the score.. Often these livability indexes are found to be acting as the primary scoring and evaluation mechanism for quality of life and lifestyle surveys, recognizing and ranking global cities on an annual basis.

Figure 1: Misfit Shine and Fitbit Surge, examples of wearable technology

Unlike the other lifestyle-based agencies, the AARP (American Association of Retired Persons) has developed a neighborhood livability index, which acts as a scalable (and customizable) livability calculator. While AARP's livability index still utilizes amenity-based criteria within its evaluation process, the algorithm behind the index "draw(s) from more than 50 unique sources of data….40 metrics and 20 policies…Metrics measure how livable communities are in the present, policies measure how they might become more livable over time."[2] This cutting-edge, holistic approach has the ability to assess the appropriate fit-ness of place in relationship to an aging population, but, like other livability index applications, continues to fall short in evaluating how the physical structure of place (i.e. natural and manmade infrastructures) can directly impact the activity or fitness levels of its residents. If livability indexes remain driven primarily by local amenity assessment, what then is the criterion (and associated evaluation methods) that could be used to measure and assess the *fit-ability* of place?

In his *Theory of Creative Fitting*, Ian McHarg posits that "…there is a requirement for any system – whether it is sub-cellular, cell, tissue, organism, individual, family, institution – to find the most fit of all environments, and to adapt both that environment and the system itself." And he continues, by suggesting that "[w]herever you find evidence of *health*…you have…incontrovertible evidence that the system has been able to identify the most fit environment, to adapt that environment, and to adapt itself."[3] Taking cues from McHarg's recommendation and holistic perspective of system ecologies – that is, looking to *health* as the ultimate criterion for evaluating the performance of an environment and its effect on the "bodies" that occupy it – and utilizing the contemporary crowd-sourcing techniques and performance-based metric recording applications, an alternative index for measuring the performance of place (and its infrastructure) could be realized. If, then, performance-based metrics, such as real-time health metrics, were to be utilized as evaluation criteria for rating the *fitability* of an urban environment in lieu of an amenity-based *livability* rating, how might we read and analyze urban environments upon the lifestyle and activity levels an urban system promotes and its direct impact on the physical health of its residents?

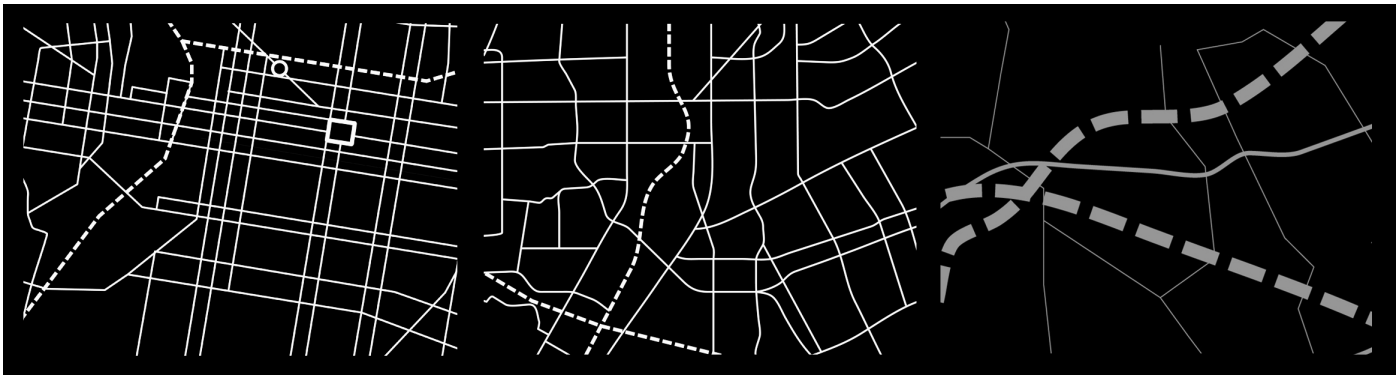

Figure 2: Grid Frameworks: Urban-Philadelphia, PA (left); Suburban-Campbell, CA (center); Rural Silver Spring Township, PA (right)

RELATING 'HEALTH PERFORMANCE' METRICS TO URBAN FORM

Today, our global culture is obsessed with measuring performance – which is primarily driven by widespread advances in computer science and "smart" technologies as well as the ubiquitous adoption of evidence-based outcomes within most industries and sectors – from medicine and education to finance, business, and technology. Our new metric-driven obsession has found its way into almost all facets of our personal daily lives through our personal cell phones or wearables – measuring our sleep cycles, forecasting our local weather, mapping our home energy usage, tallying our caloric usage, counting our steps, tracing our movement, charting our heart rate, etc. According to a recent Nielsen report, "seventy percent of consumers are already aware of wearables and about one in six [consumers] currently use wearable tech" and this percentage is continuing to grow.[4] Despite the invasion of data collection and related metrics cluttering our digital storage and personal spaces alike, the potential of mining this collective health performance data from wearable technology (and cell phone) users could prove to be an extremely vital living resource for the residents, policy-makers, designers and researchers located within a built environment of interest. In addition, the advancement and accuracy of global positioning system (GPS) technologies are entering the consumer marketplace - often found embedded within many wearable technology product lines – thus, allowing personal health metrics to be linked to place and physical urban form.

While wearable, smart technologies provide a comprehensive set of metrics that evaluate individual, personal health statistics for its "wearer", often the specific urban framework type (i.e. city grids, suburban superblocks and cul de sacs, or networks of rural routes) that promotes and/or suppresses the quantity and quality of daily fitness activity is overlooked altogether as a factor within the personal health equation. But, in fact, the scale of the urban framework with its various defining qualities (i.e. topographic condition; climatic factors; programmatic use; local population/density, etc.) delineates how one routinely moves throughout urban, suburban and rural landscapes – which not only shapes the daily lifestyle and activity levels of its inhabitants but specifies and assigns, *or fits*, transit method to place (pedestrian, bicycle, automobile, bus/light rail/subway). A deeper investigation between physical framework types and specific modes of transit would yield a clearer understanding about the role (and level of integration) that physical activity plays within the cycle of one's daily routines. As designers and researchers of the built environment, how might we utilize smart, wearable, tracking technology to further reveal the nature of these relationships - between place and framework, framework and transit fit, and transit fit to personal physical activity levels? Furthermore, how might this new means for measuring and modeling personal movement in relationship to urban form challenge conventional site analysis techniques and planning principles of urban, suburban, and rural environments and help inform appropriate retrofits within its built environment? At a time when the legibility of the category-based built environment types – urban, suburban, and rural – is becoming increasingly blurred, collaged, and re-assembled, the exploration of new measuring and mapping models to find a common evaluation vocabulary is of utmost urgency and necessity – in order to keep up with current development trends and proactively forecast threats and opportunities to quality of life conditions within our communities.

AN INITIAL PACE TEST – THE URBAN, SUBURBAN, RURAL

In order to test the proof of concept - utilizing health performance methods of one's daily movement, or pace, within the urban, suburban, and rural environments - to inform a future longitudinal pilot study and further assess accuracy of off-the-shelf wearable, health-performance devices, an *abridged pace study** was conducted. The parameters of this in-the-field experiment were quite simple. Over an aggregated three-week time period, spending one consecutive week in each of the distinctive environments, a typical daily routine of movement, *or path of travel*, was monitored, measured, and geo-located utilizing two health performance wearable devices (Misfit Shine and Fitbit Surge, Figure 1) within the urban (Center City, Philadelphia, PA), suburban (Campbell, CA, bedroom suburban town of Silicon Valley), and a rural environment (Silver Spring Township/ Cumberland County, Central PA, Figure 2). While the tandem pairing (and wearing) of the devices cross-checked the other's metric accuracy, the Fitbit Surge also provided accurate GPS information tracing the coordinates (points) of my daily movement and mapping my contiguous path (or line) of travel.

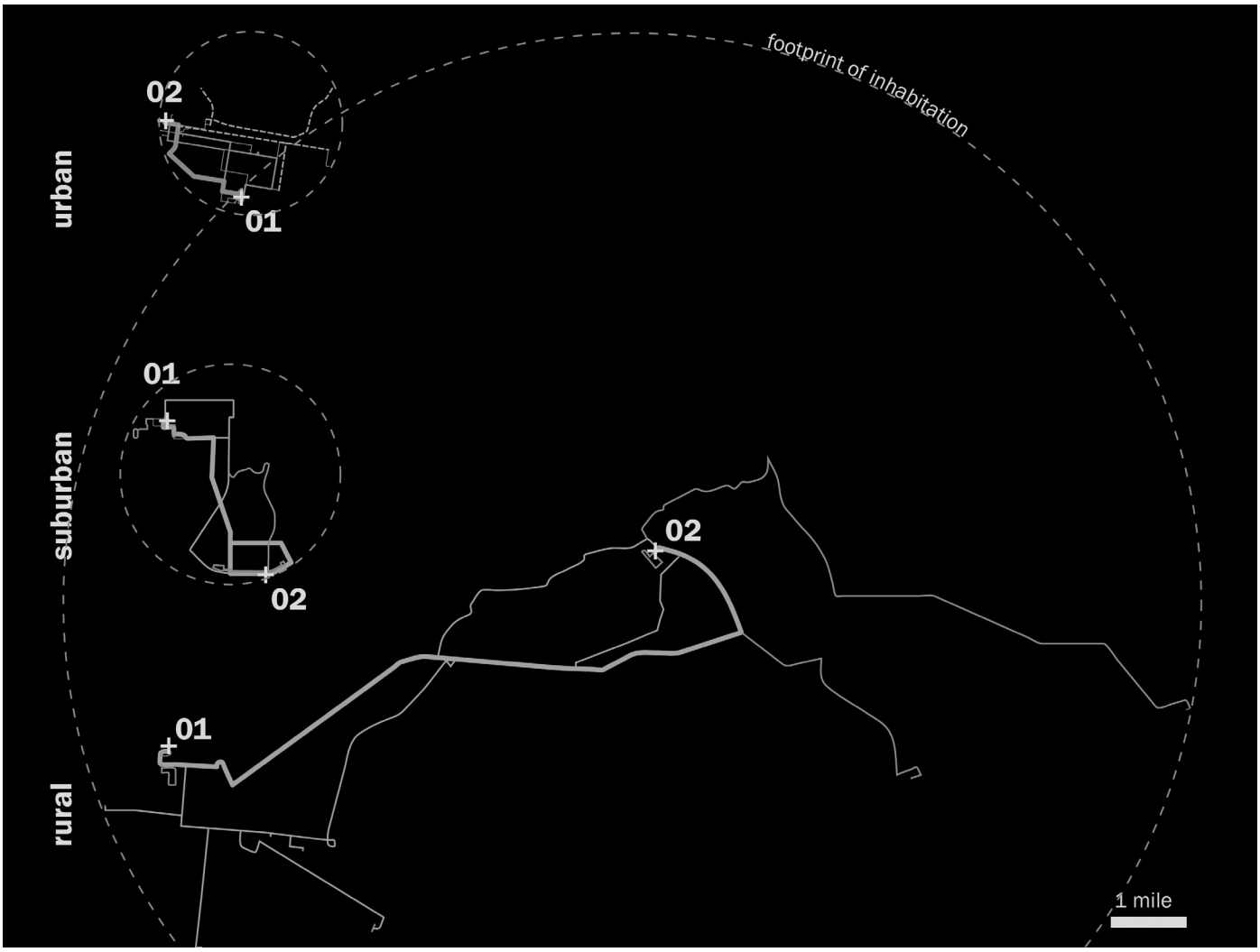

Figure 3: Path of travel tracings

**Personal Disclosure: It truly was an experiment responding in part to a recent transition into an arguably bi-coastal, tri-environment living and working arrangement over this past year. I noticed a considerable difference in daily activity levels and calorie usage, a relationship between transit mode, urban framework, and time expenditure, and varying scales of inhabitation "footprints", as I worked and traversed between three distinctively different built environment conditions.*

From a scientific research perspective, the parameters set forth by this initial study are noticeably flawed – that is, the testing subject represents a sample size of one, which is not adequate to accurately establish a mean within a greater population, not to mention, that there is a visible conflict of interest between author of the study and subject performing the study. In addition, the one-week time span of the study would benefit from a greater length of time to record the physical impact that the various urban, suburban, and rural frameworks have on a physical body, in particular weight gain/loss over several weeks. Lastly, in some instances, there was some disagreement between recording devices in step counts and distances traveled, which ultimately impact, albeit minimal, the overall "calories burned" calculations – which is a result of the quality and accuracy of the health performance devices.

Despite the shortcomings of the initial study parameters (which will be addressed in the parameters of the expanded pilot study), the study did confirm some initial general assumptions. *(Note: The findings below resulted from the recording and tracing of a typical daily routine of movement, primarily anchored by a "home" point and a "work" point with diverting errand trails.)*

Path Commuting Distances, Commuting Times and Modes of Transit: As expected given the relative scales of the three inhabited environments, the daily average path distance in the rural environment was more than twice that of the suburban environment and nearly five times greater than the urban environment (Figure3). However, in terms of total time spent along the path of travel, the urban environment yielded the longest durations (slowest rate), largely due to

a greater proportion of path traveled via pedestrian mode (2.75-4.25 miles / day compared to 1.5-2.5 miles for suburban/rural, Figure 4).

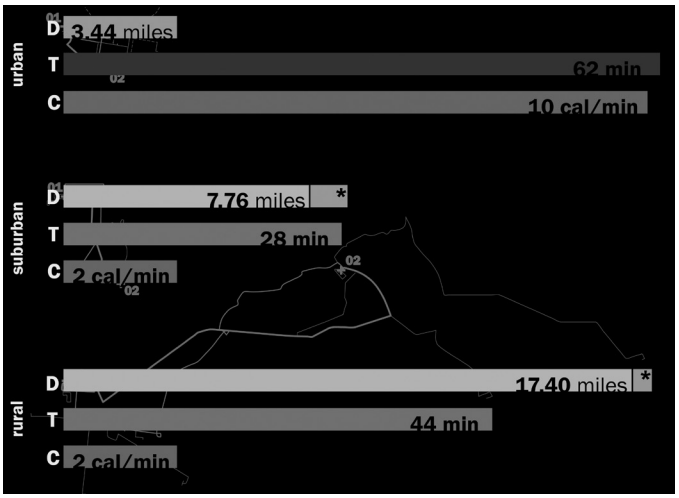

Figure 4: Relative path distance, duration and energy expenditure.

Daily Activity Levels: Comparatively, average daily activity levels (measured in calories burned) in suburban and rural environments were similar, ranging from 2500-2800 total calories while daily activity levels recorded within the urban environment ranged, on average, from 2900-3300 total calories each day. So, in other words, based on the preliminary results of this study, living and commuting in an urban environment burned an additional 100-800 calories per day. This noticeable daily increase in physical activity (especially when you consider the health implications over a series of months) is related in part to additional daily pedestrian activity (1.25-2.75 miles) in the urban environment in combination with low calorie burn rates associated with suburban and rural commuter driving (+/- 2 calories/min) versus brisk urban commuter walking (+/- 10 calories/min). (Note: Calorie calculations factor in the individual body weight of research subject.)

FORECASTING RESEARCH TRAJECTORIES AND APPLICATIONS

While the preliminary results and findings may not qualify as rigorously-tested empirical data or expose earth-shattering discoveries, the study did reveal a potential role that urban form plays in relationship to the physical health of its inhabitants and users that is deserving of more focused study. Often, the implementation (or the adjustment) of a formal urban, suburban, or rural framework and its effectiveness of integrating mobility systems with quality of livability may not be fully understood until it is inhabited, experienced, lived in – and ideally measured. The recent introduction of health performance data tracing and geo-spatial tracking technology, may in fact, provide a new and timely evaluation metric for the integrative performance of our built environment.

In Jan Gehl and Birgitte Svarre's recent publication, How to Study Public Life, Gehl and Svarre claim, "The list of questions that can be asked about the interaction between life and form is essentially endless…It is not possible to draw up a list of fixed questions that can be investigated in all areas or cities. Every city is unique, and observers must use their eyes, other senses and good common sense."[5] While Gehl, Svarre and other urban designers and researchers have been advocating for the use of on-site observation methods and head-counting as a foundation of studying public life behavior since the 1960's, the evaluation and assessment techniques used today on pre- and post- occupancy studies within the public realm - over fifty years later – still reference and incorporate on-site observation and head-counting as the primary evaluation measures. While such techniques are indisputable and surely qualify as acceptable evidence-based research, they are labor intensive, difficult to coordinate, and require a sensitive understanding of place to carry out.

In the context of today's increasingly complex urban frameworks, influenced by dynamic global economies and nascent technologies, these conventional observation methods may have reached their limits to register the nuanced intersections of complex eco-systems of exchange.

Instead, one must further investigate the hidden flows of information, analytics and invisible forces not adequately captured in plain sight. Information about our digital paths of online travel – the movement from one internet site to another – is tracked, mapped, analyzed and packaged to be sold as a commodity in the form of consumer data intelligence on the capitalist market. In the world of buying and selling data to benefit the economic interests of personal investors and corporations, how might the available technology, talent and energy be harnessed and re-directed to further advance the sustainable health of our communities - whether situated within urban, suburban or rural environments - and embed failsafe measures that promote resiliency over decay, equality over social injustice, diversified experiences over homogenous backdrops? While our current, physical environment is not capable of keeping pace with the evolving digital landscape of invisible flows of information exchange (which have real spatial and infrastructural implications within our built environments), the "smart" technology applications, as seen in the development of health performance devices, have the capability to further equip the planning, design and health-related industries with rich layers of geo-referenced data (linked to path of travel) - monitoring changes of behavior and patterns of movement in the public realm over time, how we commute, how we recreate, how we socialize, and how we live.

So, then, how might the tracking of a simple line – comprised of a physical genealogy of path, i.e. rate, distance, time, elevation change, energy expenditure, geographical referencing - change the way we currently understand the performance of our urban and rural systems? How might the inclusion of this line-based metric (in collaboration with planning area-based census data and point-based observation surveys) serve as a common evaluation measure to track the qualitative and quantitative nature of moving through the built environment, allowing for a new reading of place to emerge? Furthermore, how might these new readings of collective occupancy flows within the public realm provide us with new insights for place-making in the twenty-first century? And what are the other potential opportunities and outcomes of layering new and existing data sets, such as demographics, onto the genealogy of path? Do we truly understand how our aging populations move within our built

environments or how new immigrant populations traverse our cities and landscapes?

The qualitative nature of a path line is scalable and suggestive about the experiential nature of place and transit mode– whether informed by a tight, dense street grid, engineered curvilinear suburban streets and freeways or the jig-jagged intersection of rural routes. The illustration of an individual's collective path lines begins to reveal the nature and frequency of the programmed amenities or destination stops that gravitate towards the energy of the line. In a similar fashion, reading the formal language of the line (coupled with its health performance metrics) indicates whether fitness is truly integrated into the infrastructural framework during the daily commute (i.e. pedestrian) or if it operates as a identifiable diversion from the primary path line.

While the research potential for developing a line-based metric that is embedded with user and performance-based DNA is high, there are some obstacles that will need to be addressed. Considering disclosure protocol for highly-sensitive personal health data exchange would be a top priority as well as the development of basic methodologies for establishing individual tracking and sampling size protocols for sustained longitudinal study. Questions about data management and the ownership of the data are also interesting issues to reflect on, especially in regards to the establishment of appropriate monitoring and management agencies. At a time when governing and utility agencies are beginning to provide public access to their once-coveted data sets, the stage has been set for developing new analytical models for community-based data sharing (in collaboration with crowd sourcing platforms) – with the intention to provide a more precise understanding of the pace of place, ultimately helping to inform suitable planning, design and policy decisions for the community.

RETRO-*'FITBIT'-ING*

Suburban sprawl accommodated the perceived needs of a growing post-war population in America, and grew throughout the second half of the twentieth century along with local commuting times and an obesity epidemic. Despite our housing crisis almost a decade ago, when housing stock far exceeded market demands, the long range forecast for our current settlement patterns to accommodate new urbanization is inevitable. In some markets, where the swelling (or in some cases, the shrinking) of specific industry sectors have literally disrupted the livability and health of the built environment. The retrofitting of place has often become a knee-jerk reaction to temporarily fix a problem, without substantial long term planning, policy or health-related objectives or efforts in play. Growth may be inevitable but how can a community measure its own health performance beyond counting cars and lifestyle amenities. There is a tipping point – where the balancing of community health, and the overall health of its inhabitants (both mental and physical) is overshadowed by sudden economic growth (and wealth), disrupting the physical capacity and initial planning intentions of its urban model. Silicon Valley is one example of this condition. In a recent New York Times article, frustrations from one of its local political leaders exclaimed, "We're going from suburban to urban, with nothing in between. The community is reacting in hugely negative way. We almost have riots."[6]

While there is no singular evaluation metric to completely predict the tipping point or incapacities of an urban form (or even the moment of inhabitant uprisings), utilizing the technology of health performance metrics to inform the nature of paths of travel might provide necessary information to fill the gaps between point-based (i.e. headcounts) and area-based (i.e. census tracts) analytic models. Together these analytical models that assess real-time data collection might, in fact, inform the most fit, health-based strategies that amend in moderation, or retro-*'fitbit'*, the structural frameworks of the urban, suburban and rural environments. Or, it may be best summed up by another politician expressing concern over the urbanization of the Silicon Valley, "A glass of wine at dinner is good. Chugging a gallon is not."[7]

ENDNOTES

1. United Nations Department of Economic and Social Affairs/Population Division, *World Urnbanization Prospects: The 2014 Revision* (New York: United Nations), 2015, 1.
2. "AARP Livability Index," https://livabilityindex.aarp.org/.
3. Lynn Margulis, James Corner, and Brian Hawthorne, eds., *Ian McHarg Conversations with Students* (New York: Princeton Architectural Press, 2007), 21-25.
4. Nielsen Newswire, March 20, 2014, "Are Consumers Really Interested in Wearing Tech on Their Sleeves?" *Neilsen*, http://www.nielsen.com/us/en/insights/news/2014/tech-styles-are-consumers-really-interested-in-wearing-tech-on-their-sleeves.html.
5. Jahn Gehl and Birgitte Svarre, *How to Study Public Life (Washington: Island Press, 2013), 11.*
6. David Streitfeld. '"We Almost Have Riots': Tensions Flare in Silicon Valley Over Growth," *New York Times,* November 4, 2016, accessed November 7, 2016, http://mobile.nytimes.com/2016/11/05/technology/silicon-valley-california-growth.html?_r=0&referer=https://www.google.com/.
7. David Streitfeld. '"We Almost Have Riots': Tensions Flare in Silicon Valley Over Growth."