The Data/Tech Wave is Growing: How Can We Get More onto the Geodesign Surfboard?

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Abstract: It is a provocative juncture: two trends, each significant on their own, are on an upsurge at the same time; their intersection can provide unparalleled opportunities. The proliferation of geospatial data is a trend with no signs of stopping. Data is easier to access, while simultaneously harder to discern its significance. In recent years more entities are recognizing the benefits of design. The trend of using design's creative problem solving approach to infuse greater value in the solution is growing. Geodesign is a place-based design process that expressly joins values-laden creative problem solving with geospatial data in a collaborative method. This paper discusses the great promise this intersection provides for impactful, meaningful solutions to addressing complex environmental challenges.

Keywords: Geodesign, data, metrics, geospatial, crowdsourcing

1 Introduction

A threshold has been crossed – we are now living in a data-rich world, and one in which this data is increasingly more easily accessible. In the fall of 2017 the CEO of Intel, Brian Krzanich, suggested that "bits and bytes will replace petroleum as the primary fuel for the world's economy" (SIMPSON 2018). In relation to design, there is a growing chorus forecasting that design can no longer be separated from data (ROLSTON 2014, SIMPSON 2018). There are however still many who underestimate the power and potential of data (CHAKRAVARTHY 2017). The main subject of this paper is the design process called geodesign. It is a design process that very specifically marries science, and in particular geospatial data, with an iterative, collaborative creative approach to addressing land use design and planning challenges (FOSTER 2016). The importance of the data aspect of the geodesign process, and an emphasis on the need for a greater understanding of its value to the design fields, is the central proposition of this paper.

2 Data Availability and Relevance to Landscape Architecture

The role of gathering and understanding information about a place has always been a hallmark of landscape architecture. The way that information, which in this paper is called data, can be acquired is constantly evolving. Additionally, the quantity and types of data available are growing. The wide range of physical, biological, phenomenological, cultural and economic data that have always been the root of site analysis is expanding and that is now joined by social data, personal health data, real-time data (tracking), and learning or experience data.

Designers can now find reams of data available about their project locations, however not all data is equally useful or viable. Dr. Steintiz maintains that you must first clearly understand the problem in order to determine what data is best suited to assist in the geodesign process (2012). There is also a "value chain" of data that can be linked to outcomes-based value

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creation (GOLDEN 2018). The most basic data is descriptive (what is there or has been there). Predictive data is derived from analyzing patterns and modelling to forecast potential future scenarios. For designers, the ultimate goal is to designate or recommend an approach (or approaches) which are linked to desired outcomes. This is called prescriptive and is the most complex use of data, involving optimization and simulations (see Figure 1).

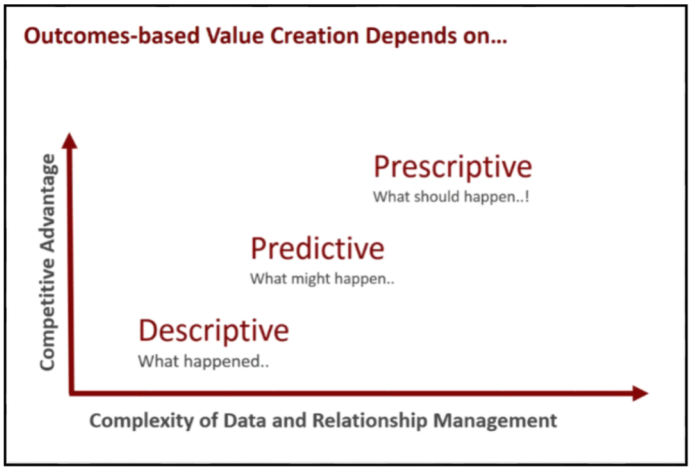

Fig. 1: Golden 2018

It may be beneficial to review a few examples of how data is evolving, particularly in the ways that landscape architects can acquire data for their project locations. The first example is guidance for specific data needed to advance a desired outcome. The second is the use of drones. The third example is crowdsourcing and the last example is an app for experiential data.

The American Planning Association (APA) published a report in 2017 targeted to designing healthy communities. The express goal of the publication is to outline consistent metrics that can be used across diverse communities. In Figure 2, the "built environment assessment indicators" column provides a guide as to the data needed to design and plan for the outcome goal of creating a community with a Healthy Food System (RICKLIN 2017). As mentioned above, clear recognition the problem and in turn the criteria for achieving a desired outcome is important to understand at the onset. These indicators point out what data needs to be gathered for a project. The APA report outlines built environment assessment indicators for five domains considered critical to community health: 1) active living, 2) healthy food system, 3) environmental exposure, 4) emergency preparedness, and 5) social cohesion (RICKLIN 2017).

Healthy Food System Metrics for Planners			
Domain	**Subdomain**	**Built Environment Assessment Indicators**	**Planning Policies**
Healthy Food System	Access	❑ Percentage of low-income population living in urban areas that are not within walkable distance of a full-service grocery store ❑ Percentage of farmers markets that accept SNAP/WIC ❑ Percentage of corner stores that have healthy food options ❑ Density of fast food restaurants	Incentive programs to attract full service grocers to food deserts Financial incentives to corner stores for carrying healthy food choices Policies that expedite the permitting process or provide incentives for the development of new farmers markets Regulations prohibiting or limiting new fast food establishments
	Production	❑ Acres of urban area that are currently in use or have potential for community gardens or urban agriculture	Remove policy barriers to establishing urban agriculture and community gardens

Fig. 2: Ricklin 2017

Drones are increasingly becoming available for a variety of uses related to site design and planning. There are many types of drones and their use for acquiring local geospatial data when it is missing or lacking is creating exciting opportunities. PEG landscape + architecture faced this in their research along the Delaware River in Philadelphia when key parameters needed to design a way to transform hard edges to living shorelines were missing. Their work required reliable data to be able to perform hydrodynamic simulations (PEG). The team deployed a water drone equipped with GPS and depth instruments to collect the needed data (HOLMES 2018).

There are an amazing array of opportunities to engage citizen-scientists and local stakeholders in acquiring data. An example of a crowdsource platform that can be used for community engagement is map.social. It is built on Esri's platform and allows the creation of individual or shared maps. As the name implies, this is a way to dynamically gather community-values related data. A different example of crowdsourcing is iNaturalist (www.inaturalist.org/) which has both local and potentially global implications. User reported observations are also shared with scientific data repositories, such as Global Biodiversity Information Facility, which provides free access to data sets (https://www.gbif.org/).

As the world gets increasingly more digital, experiential, quantitative data is now a by-product of peoples' connected lives. Gaining access to that can contribute to a more human-centered design process. "…observing what people do and how they interact with their environment gives us clues about what they think, feel, and need. This helps us uncover insights and inspire new design solutions" (MCCLAIN 2017). An example that creates a daily storyline, which is mapped to places, is the MOVES app (https://www.moves-app.com/). A hallmark of geodesign is collaboration with stakeholders. These evolving crowdsource and experiential ways to gather data provide engaging opportunities to involve the community.

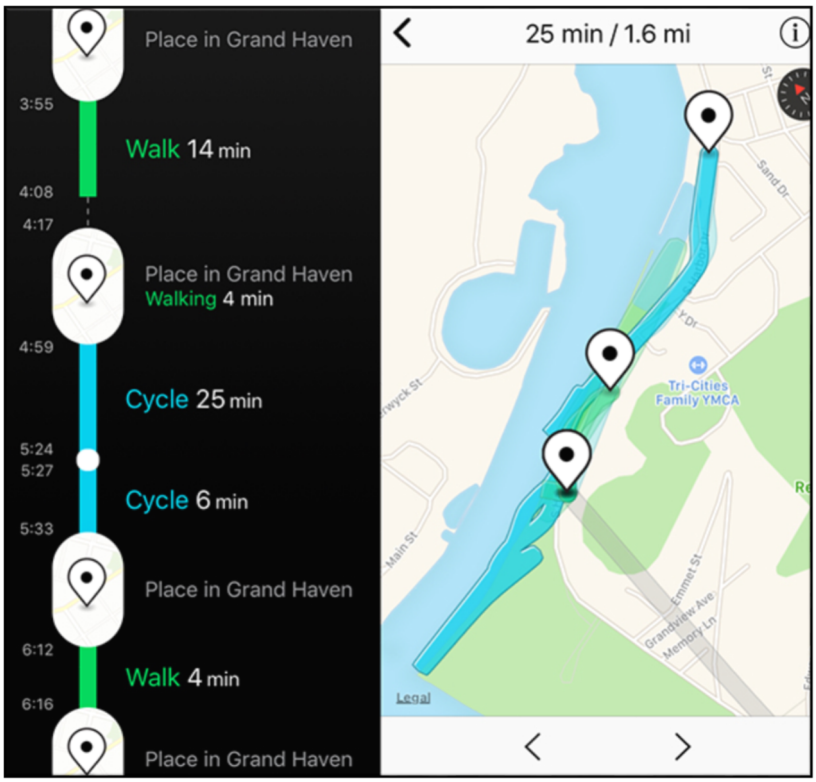

Fig. 3: Example of MOVES app from author's use

There are urgent calls for computer scientists and artificial intelligence researchers to prioritize work on environmental sustainability topics (JOPPA 2017). I believe there also needs to be an urgent call for how best to sort out and use all this data. Although there are still many gaps in data, particularly in natural systems, there is a great need for expertise that can assist in advancing the use of data for the mutual benefit of humans and the natural world. This is a role for designers – to channel their ability to empathize, read and interpret contexts, and devise creative responses to complex problems.

3 Clarifying the Role of Design

The business sector and other industries are beginning to understand the transformative role that design can play in how they operate (KOLKO 2015, PRESS 2017). Design thinking is no longer solely the realm of those trained as designers. Many believe that designers need to step up their interaction with and influence in other industries and arenas to maintain a standard of quality and a level of authority in the field, or risk having it erode or even worse, seeding their stature altogether. To put a positive angle on this – design's currency and the recognition of the benefits it can provide to a variety of endeavors is rising rapidly. At the

same time, as argued earlier, data is also on the rise – its quantity, influence and importance. An approach that merges these and highlights the strengths of both should, then, also be on the rise. Bringing together science (data) and design is at the core of the geodesign process (STEINITZ 2012). Geospatial data, in the form of GIS (Geographic Information Systems/Science), has become a well-respected and multidimensional science (LONGLEY 2011, WILSON 2015).

Let's consider how key innovators in design envision it's future. In the fall of 2017 a list of nine ideas emerged from a solicitation asking what will most impact the design industry in the next few years (BUDD 2017). The results provide a close correlation to the collaborative, multi-model and systems-based approach to geodesign espoused by STEINITZ (2012) and others:

> "Geodesign is a method which tightly couples the creation of design proposals with impacts simulations informed by geographic contexts and systems thinking and supported by digital technology." MICHAEL FLAXMAN (2010)
>
> "Geodesign is an iterative design method that uses stakeholder input, geospatial modeling, impact simulations, and real-time feedback to facilitate holistic designs and smart decisions." SHANNON MCELVANEY (2013)

Nine ideas shaping the future of design (BUDD 2017):

1. Designers Will Become "Mutagens"
2. Systems Thinking Will Be Foundational
3. Designers Will Interrupt the Cycle of Capitalism
4. Designers Will Become Activists
5. Politics Are the Next Design Frontier
6. Ethics Are No Longer Afterthoughts
7. Design Will Become More Genuine
8. Designers Won't Be Humble
9. Designers Will Become One with Machines

While nearly all of these can be associated to some aspect of the geodesign framework process, for this paper, I will highlight three as most central to geodesign's role in the future of design. In #1, Carlo Ratti is arguing that in order for designers to address the most complex problems facing the world today, a new approach is needed: "a collaborative, inclusive, network-driven process inspired by 21st-century, digital-driven trends such as crowdsourcing, open access, … designers today are well placed to play an orchestrating role" (BUDD 2017). Steinitz often equates the geodesign process as similar to conducting an orchestra – where those leading the design process engage with select "instruments" (professionals and stakeholders) as needed and relevant, depending on the issues. Ratti's forecast aligns well with Flaxman's definition of geodesign (2010).

Systems thinking has been an essential tenant of geodesign from its origins. In #2, Tim Brown insists that a systems based approach will result in better designs: "Everything we design has to be a learning system; it can't just be an artifact. So much technology today makes it possible. Sensors, smart software–they learn about what's happening, they learn what people are doing, and what their effects on the system are. We can gather insights about what the designs can do, and they will become more and more powerful in turn" (BUDD 2017).

Brown's statement relates directly to the "impact simulations, and real-time feedback" part of the geodesign process espoused by MCELVANEY (2013).

The last one, #9, gets to the heart of the matter; Mark Davis is concerned with designers' willingness to embrace technology. "What troubles me is the slow rate of change in design practice. The available technology, particularly breakthrough innovations around machine intelligence are changing at a furious pace, but the … design culture has not been able to keep pace." He talks about the growing importance of new applications, particularly artificial intelligence and its role in driving generative design technologies (BUDD 2017). Designers' lackluster interest in technology is not a new issue; it surfaced early on as GIS developed. However I maintain that two things are now in our favor as we move forward. First, landscape architects have always had members of the profession who gravitate towards and respond well to technology – we need to create ways to foster those interests even more so today. And second, we are now at the point where young professionals entering practice are digital natives. Their natural affinity for technology holds great promise for adoption and adaption – we just have to ensure the non- digital native managers and firm owners avoid becoming an impediment and instead they recognize the unique form of innovation these digital natives can contribute (CAPPELLI 2018).

What I find most remarkable is here are some of the top innovators forecasting a future for design, albeit all types of design, but it sounds as though it was written to describe geodesign. The future of design as they envision it embodies much of what geodesign is and does, and when that is coupled with fully embracing data – the opportunity is amplified.

4 Conclusion and Outlook

As this paper outlines, many factors and resources are aligning to position geodesign to flourish – however geodesign's unique process and embrace of data and technology has still not yet caught on widely. Here are five ideas I believe will enable more designers and landscape architects to get onto the geodesign "surfboard" to ride these waves of opportunity:

1. Landscape architect's historic hesitancy to embrace technology should be lessening. Technology now permeates our everyday activities providing ready familiarity and expectations. Patterns of human adoption show that initial reactions of "I don't need this" evolve to "I can't live without this" (GOLDEN 2018). Additionally, design-related technology is getting easier to use and access. GIS and related technology is more intuitive and design-sensibilities friendly (i. e. you don't need to be a programmer to use it).

2. A growing segment of the design profession are digital natives. They have no fear of technology, great ambition and they can think and innovate in ways non-digital natives can not. They must be empowered to take on these opportunities.

3. Many award winning design offices have research divisions or partner with universities. A hallmark of Geodesign is the recognition that differing expertise and strengths are needed throughout the process as well as based on the type of design challenge. Collaboration with geospatial analysts or scientists, or whichever expertise is needed, advances the effort while maintaining overall project control. In other words, designers are well positioned to lead projects in an "orchestra conductor" role.

4. To enable this important work and geodesign expertise to connect more widely, we need to adopt vocabulary that will resonate with other audiences. Perhaps consider terminology Engineering uses, which garners attention and funding. I would argue that these terms apply to what Geodesign offers and does:
   - Computer optimization
   - Assistive technologies
   - Speculative prototype
   - Rapid prototyping
   - Address complex geometries

   We need to reframe and rephrase what we do so that others better understand the role geodesign can play in addressing their challenges.
5. I firmly believe we need to bring our message and accomplishments to broader audiences. There are numerous market segments that are looking for geodesign solutions. The corporate world wants to reduce the likelihood of disruptions due to environmental problems. Insurance companies, the military – all face place-based design challenges (BUDD 2017). What if the United Nations Principles on Responsible Investment (https://www.unpri.org/about) required applicants to conduct at Geodesign process as part of the protocol?

FRIEDMAN (2016) asserts that to understand our world today, we need to realize that the three major planetary forces "Moore's law (technology), the Market (globalization), and Mother Nature (climate change and biodiversity loss)" are all accelerating at the same time. He maintains that the jobs needed now and in the future must be rooted in "STEMpathy." All the innovations in science, technology and math must also be coupled with "moral innovation" and human empathy to succeed. Geodesign is that bridge, or Venn diagram as STEINTIZ illustrates (2012). It is a decision maker-driven design structure that ensures humanity has a key role in creating the vital solutions needed for the future of design.

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