

Living in Information

Architecture for Life Inside Small Glass Rectangles

by Jorge Arango

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Who This Book is For

"But," you may protest, "I'm not a software designer!" Don't worry – I'm not talking about people who have the word *designer* in their job title. As you'll see, I have a rather broad understanding of what design is. If you are responsible for a digital product or service, or part of a team responsible for one, you will benefit directly from understanding how to design more sustainable information environments. And if you aren't responsible for such a system, you will still benefit from reading this book. Many of the most important decisions in your life are mediated in places that happen in small rectangular screens. It behooves you to understand how information environments affect your behavior.

How the Book is Structured

The book is divided into ten chapters. Chapters 1-5 describe information environments: what they are, how they work, and the forces that form them. Chapters 6-10 focuses on ways we can design information environments so that they work better over the long term. They are best read in sequence.

- Chapter 1 describes what we mean by environments, and explores the differences between physical environments and information environments.
- Chapter 2 discusses context: how we understand where we are and what we can do there.
- Chapter 3 delves into how environments take the form they have by examining the incentives that drive their creation.

- Chapter 4 examines one of the most important of these incentives: the drive to control your attention.
- Chapter 5 examines another important force that influences information environments: technology. We'll also look at emerging technologies that are likely to affect how we experience information environments.
- Chapter 6 discusses architecture as the reference for designing effective information environments.
- Chapter 7 focuses on the semantic structures that support information environments.
- Chapter 8 broadens the picture by examining how information environments participate in and create systems.
- Chapter 9 turns the discussion to ways in which we can make these systems more resilient.
- Chapter 10 brings everything together into a stewardship model for information environments that support wholeness in the long term.

Chapter 9 - Sustainability

"When we build, let us think that we build for ever."

– John Ruskin

"This design will still be new and fresh 50 years from now, we think... What we have is magnificent." These were the words of A. L. Scott, President of the Kimbell Art Museum's board of directors, after the building's opening.¹ Time has proven Mr. Scott right; since it opened in 1972, Kahn's building has come to be recognized as an excellent example of museum design and a modern classic.

Given the expense and effort that goes into making buildings, it's natural that they should aspire to longevity. Some, like the Kimbell, achieve it. But like all systems, buildings are always changing. On the one hand, you have the forces of nature relentlessly wearing down physical materials; left unmaintained, buildings quickly deteriorate. On the other, you have changing conditions – both internal and external – that change how we understand and use the building. For example, new technologies may appear that cast a particular building's use irrelevant. Or perhaps the character of the neighborhood around the building changes, forcing new approaches. Or tastes shift and what seemed fresh and hip one year is old-fashioned and irrelevant after a decade. Or the organization that commissioned the building moves on, and another

¹ <https://fashionpluslifestyle.wordpress.com/2013/11/14/the-kimbell-art-museum-unveils-newest-acquisition-a-luminous-pavilion-by-renowned-architect-renzo-piano-november-27-2013/>

one – with a different set of needs – occupies the premises.² Whatever the case, as stable as built environments may appear, they don't stay the same for long.

This malleability is even more true of information environments, which don't have to contend with the constraints of physical materials. Deploying a change to the navigation structure of a mobile app requires design, development, and testing efforts – but it doesn't require bulldozers and building permits. Information environments also exist within a context – that of information technology – which is evolving very fast. For example, iOS 7 introduced a completely new visual design to the iPhone's operating system. From one day to the next, the feeling of the entire information environment changed, and perfectly functional applications that didn't immediately implement the new style suddenly looked old and out-of-place. This change was experienced by millions of people literally overnight.

So if environments are to stand the test of time, they must be able to accommodate change. However, they can't change thoughtlessly, lest they fail to serve their intended functions. People must feel like they know the place when they visit; an environment that is changing in radical ways from one day to the next would be difficult if not impossible to use. Thus, the environments that best serve their goals over the long term as the Kimbell does strike a balance between flexibility and stability. They provide coherence and understandability while evolving gracefully in response to changing conditions. In other words, their structures and systems must be *resilient*.

² I've taught classes at a former bus depot in the San Francisco campus of the California College of Arts.

Resilience

I define resilience as the ability of any system – including environments such as the ones we've been discussing – to respond and adapt to change without compromising its primary purpose or its integrity. Change can be incremental, such as erosion caused by the elements or the gradual reduction of a critical resource. It can also be sudden. For example, I work in an old building in Oakland, California, which is in a seismically active zone. This building has been retrofitted so it can keep safely continue functioning as a building (its primary purpose) after being subjected to the forces of an earthquake (sudden change.)



This concern with the resilience of the environment is not new. One of the earliest building codes in the world appears in the Code of Hammurabi, which is over 3,700 years old. It states:

229 *If a builder builds a house for someone, and does not construct it properly, and the house which he built falls in and kills its owner, then that builder shall be put to death.*

230 *If it kills the son of the owner, the son of that builder shall be put to death.*

231 *If it kills a slave of the owner, then he shall pay, slave for slave, to the owner of the house.*

232 *If it ruins goods, he shall make compensation for all that has been ruined, and inasmuch as he did not construct properly this house which he built and it fell, he shall re-erect the house from his own means.*

233 *If a builder builds a house for someone, even though he has not yet completed it; if then the walls seem toppling, the builder must make the walls solid from his own means.*

The intent here is not to specify *how* structures are meant to be resilient, but rather to incentivize builders to do so. Using incentives such as these, architects have long had "skin in the game" of keeping our environments useful and safe over time.

Information environments, too, are subject to changes. Some of these are internal, such as the launch of a new product or service. Others are external, such as the appearance of a major new platform or interaction mechanism. For example, after the introduction of the iPhone in 2007, most people access information environments using small touchscreen-based devices. Many information environments designed before

2007 had to adapt to the constraints and possibilities of this platform to remain relevant.

This ability to adapt and change in response to changing conditions is essential if an environment is to continue serving its purpose over time. However, it shouldn't be taken for granted. Several factors will determine how resilient an environment can be, including its size, complexity, malleability, and degree of dependence on other systems. Beyond that, much rides on the people responsible for managing the environment:

- The team must have a healthy *attitude* towards change. They should embrace change as natural and expectable and have the willingness to respond by altering the environment accordingly.
- The team must have *awareness* of what is happening within and without the environment. They can only respond appropriately to change if they can perceive it.
- It may be that the team sees what needs changing, but lack the resources or political support to respond. Thus, the team must be *empowered* to respond to changes.
- The team must have a *clear vision* of the purpose and essential character of the whole and how people use it. Understanding the whole is important if the team is to respond without compromising the environment.
- The *design* of the environment must accommodate change gracefully. Some do this better than others; much depends on the environment's structural configuration. More on this later on in this chapter.

In order to be resilient, environments need to be *sustainable*. You can think of sustainability as creating the conditions necessary for a system to meet the needs of its

present stakeholders without compromising the needs of its future stakeholders. In the case of the physical environment, our primary goal should be to ensure it can usefully host our activities in the long term. When dealing with an information environment, our goal should be to make sure that it can host meaningful interactions in the long term. To do this, it must sustain:

- *Itself*; the environment should be able to generate enough resources to support its continued existence.
- *Its purpose*; the environment should generate these resources without compromising the reason(s) why it exists.
- *Its social context*; the environment should achieve its purpose(s) without compromising the societies that host it.

These goals mirror the goals of sustainable development formulated during the [2005 World Summit on Social Development](#): the *economic, social, and ecological* "pillars," or fundamental aspects of the system. Let's see how they map to our work.

Economic Sustainability

Creating and maintaining an information environment requires resources. These resources include labor to design, build, test, and manage software, servers to host it, energy to power them, infrastructure to deal with logistics, and more. The system should be able to generate enough value to produce the resources necessary to ensure its continuing existence. This seems like an obvious statement, perhaps one not even worth mentioning. However, some information environments have gained tremendous social importance without having a business model that points to their

continuing viability.³

Social Sustainability

Information environments exist within a broader social construct. For them to remain viable in the long-term, society as a whole must continue to be viable as well. By viable, I mean the society must continue to work well for the people who participate in it without compromising itself or the environments it exists within. The social fabric must encourage cooperation between diverse people towards common goals.

Again, this seems like an obvious thing to say. However, many information environments depend on business models that, while viable from the economic perspective, may be socially unsustainable. For example, advertising-based business models can be problematic, since advertising drives us towards more consumption and does so by targeting us as members of ever-narrower demographic segments. Given the challenges we face as a society, we should be striving instead to be more mindful of our consumption and more focused on the things that unite us.

Environmental Sustainability

Information environments create communication ecosystems that can either sustain or harm our societies' long-term prospects. We need to consider their impact on these ecosystems. As we saw in chapter two, communication happens in semantic environments that have parallels to physical environments. The goal of these semantic envi-

³ The most notorious of these is Twitter, which has become an important means for the U.S. Government to convey policy decisions, even though it hasn't yet demonstrated a path to sustainable growth.

ronments is to *convey meaning*. Like the physical environment, semantic environments can become polluted, making them incapable of achieving these objectives. In semantic environments, pollution happens when the language, rules, and purposes of one particular semantic environment (e.g., science) start to become blurred with those of another (e.g., religion).

For example, after the 2016 U.S. election, there was much talk about the problem of "fake news" in social networks. What this means is that a particular semantic environment (social media, which we're using to inform our worldview) is becoming polluted with material from another semantic environment (outright propaganda, or in some cases, satire). The effect, overall, is to erode the meaning of the word "news", making certain types of conversations more difficult.

As we saw in chapter four, disinformation has been around for a long time. However, the pervasiveness of information today, the fact that now we move much more fluidly between different semantic environments, and how easy it is for people to spread information virally in information environments make today's information environments particularly prone to problems of disinformation. It behooves the designers and operators of these environments to understand how they can become polluted, and work to ensure that the transmission of meaning can happen as "cleanly" as possible.

Designing Environments That Accommodate Change

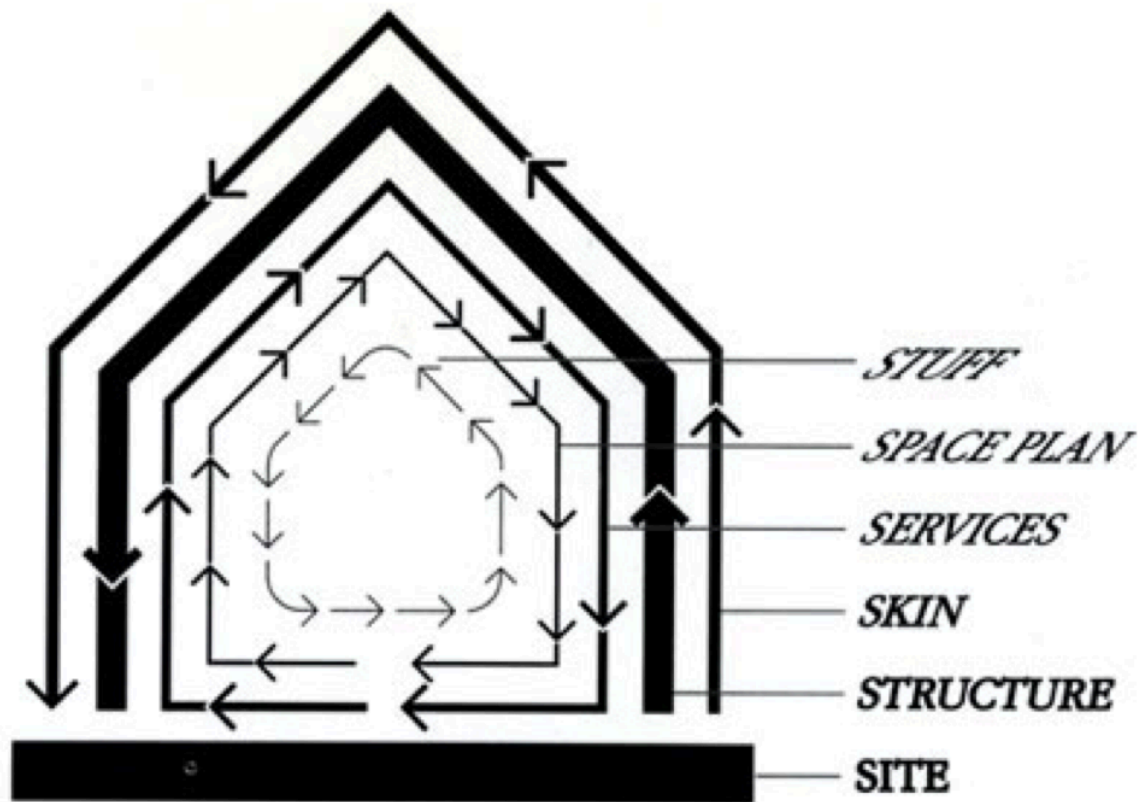
As we saw in chapter seven, information environments have underlying semantic structures. As with the load-bearing structures in buildings, these semantic structures

change more slowly than other aspects of the information environment. So if we want to create information environments that successfully convey meaning and maintain their integrity even as they evolve, we must carefully design their conceptual structures and the semantic structures which implement them. This is especially important because these semantic and conceptual structures tend to be longer-lived than other aspects of the environment.

I'd understood this idea conceptually, but it became very tangible when I was working on the fourth edition of *Information Architecture: For the Web and Beyond*. One of my tasks in that project was updating the examples in the book, which required that I re-visit many of the websites featured in previous editions. One of those websites – Fedex.com – had a very different visual presentation in the mid-2000s (when the third edition of the book was written) than it did ten years later. However, when I started examining the site's semantic structures, it struck me how little they had changed over that decade. I've seen this in my work as well: It's not uncommon for organizations to overhaul their websites' and apps' "look and feel" while leaving their primary categorization and language schemes mostly untouched.

Buildings, too, have some elements that change more slowly than others. Stewart Brand's book *How Buildings Learn: What Happens After They're Built* popularized the *shearing layers* model, which was originally proposed by the architect Frank Duffy. The idea is that buildings are composed of layers that change at different rates. These layers are (from slowest to fastest): site, structure, skin, services, space plan, and stuff. "Site" – the ground upon which the building rests – changes very slowly, at a geological pace. "Stuff," on the other hand, refers to the things we put inside buildings, such as furniture and appliances, which can easily be moved and therefore change much faster. As buildings adapt to evolve, the form they take is affected by the differences in

the malleability of the various layers.⁴

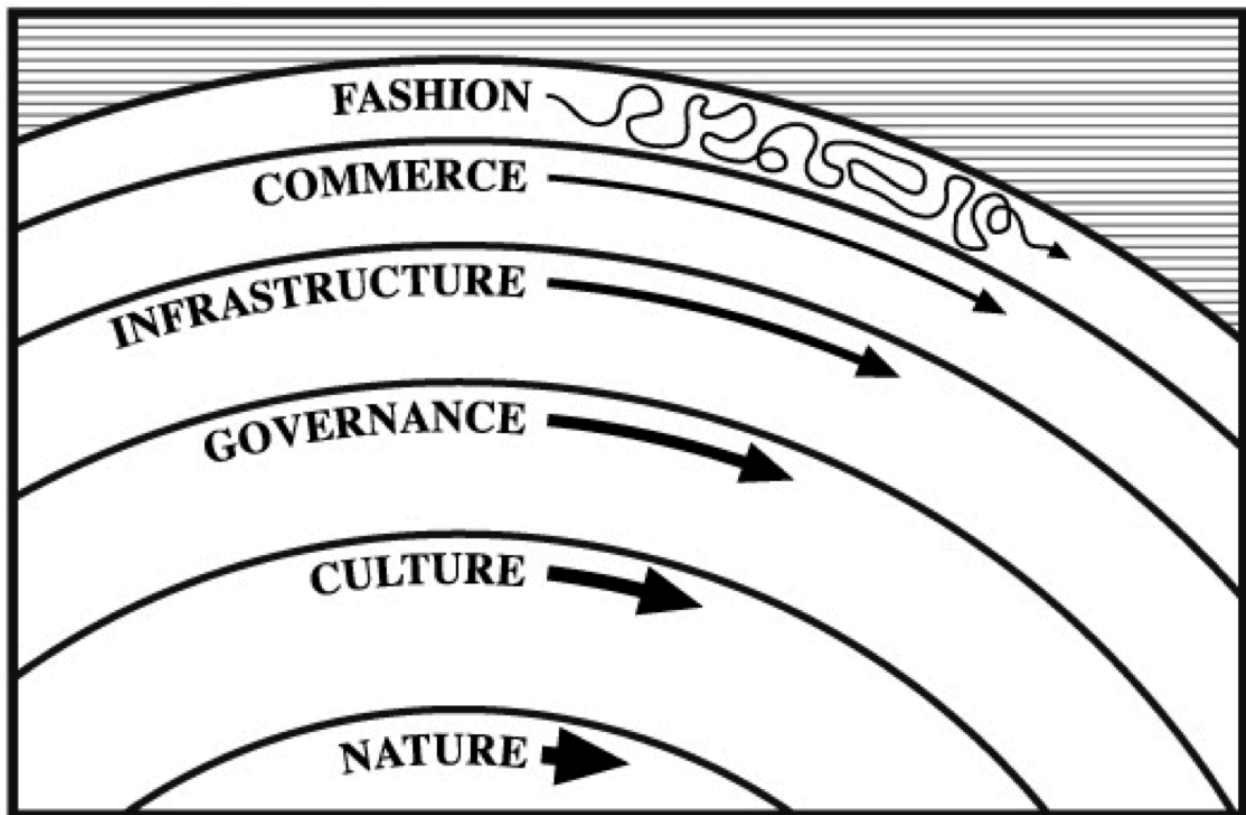


Brand subsequently extended the shearing layers model to explain how *civilizations* change. This broader model is also composed of six layers (again, from slowest to fastest): nature, culture, governance, infrastructure, commerce, and fashion. Brand explains that because fashion (and art) change so quickly, this is where the civilization experiments with new ideas and ways of being. Worthwhile ideas are assimilated into the underlying layers, where they become more permanent parts of the civilization. As Brand explains,

⁴ Brand, S. *How Buildings Learn: What Happens After They're Built* Penguin Books, 1995.

The combination of fast and slow components makes the system resilient, along with the way the differently paced parts affect each other. Fast learns, slow remembers. Fast proposes, slow disposes. Fast is discontinuous, slow is continuous. Fast and small instructs slow and big by accrued innovation an occasional revolution. Slow and big controls small and fast by constraint and constancy. Fast gets all our attention, slow has all the power. All durable dynamic systems have this sort of structure; it is what makes them adaptable and robust.

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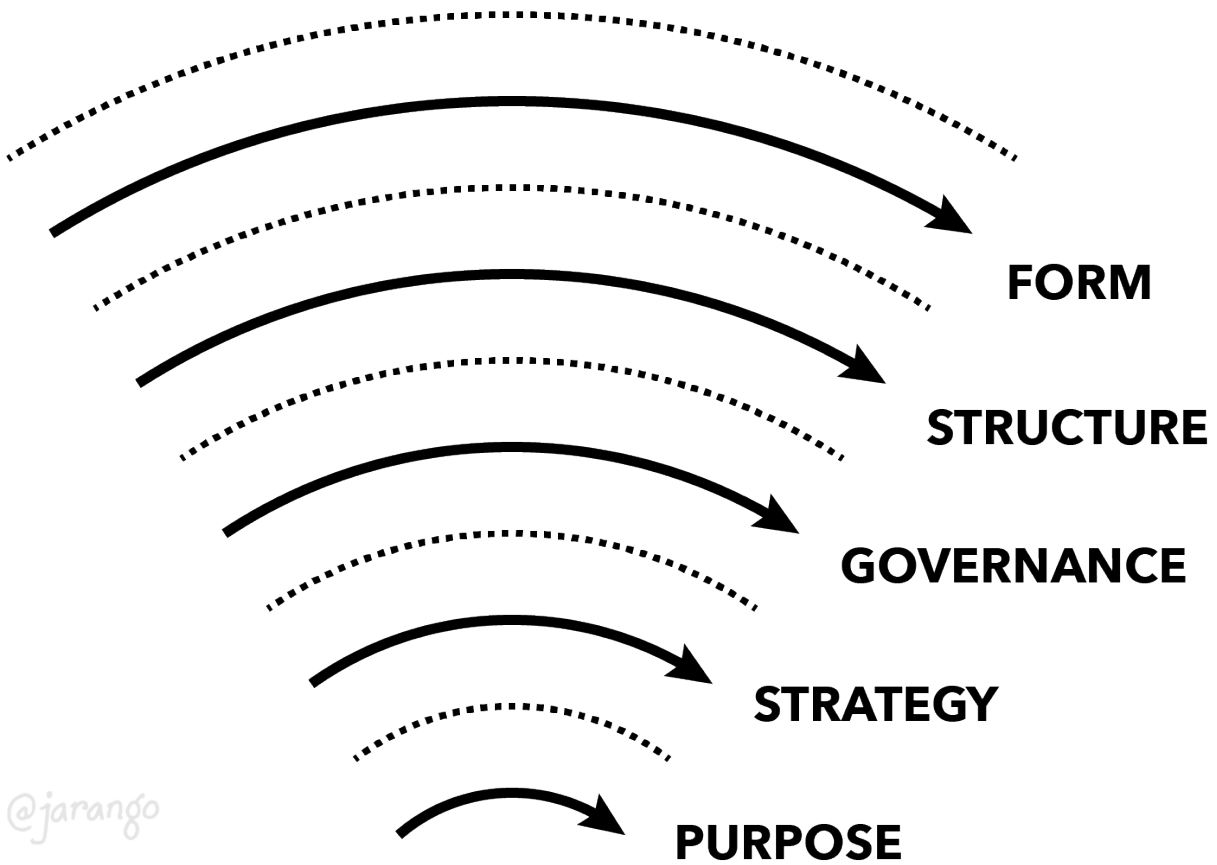


⁵ Brand, S. *The Clock Of The Long Now: Time and Responsibility* Basic Books, 1999.

This is a very useful insight. It helps us understand how the unevenly-changing parts of a system can help make it stronger as it evolves.

As I've been thinking about how to make information environments more conceptually sound and resilient, I've started mapping my work to a pace-layer model. These are the layers I've come up with, from slowest to fastest:

- **Purpose:** Why the organization, team, or product exists. This is not a goal since it can never be achieved; it's an aspiration that the system is always working towards.
- **Strategy:** How the organization aspires to do things differently to strive towards its purpose; how it's going to compete.
- **Governance:** How the organization shapes itself to implement its strategy. The rules and means of engagement, including the organization's internal hierarchy.
- **Structure:** The relationships between particular semantic elements that will inform end products and services.
- **Form:** The user interfaces that people use to interact with the organization's products and services. This layer is where the structure is articulated as artifacts that humans can experience.



I separate form from structure for two reasons:

- As I mentioned earlier, the structure that informs these products and services changes more slowly than the user interfaces that are built upon it.
- We experience the things we design through apps, websites, social media, and a variety of other touch points. For the sake of coherence, an organization's various user-facing artifacts should share a common semantic structure.⁶

⁶ In *Pervasive Information Architecture*, Resmini and Rosati refer to this as *consistency*.

Many designers spend a disproportionate amount of time focused on the form layer. This emphasis is understandable. The user interface (UI) is where the "new and shiny" action is happening. It's also much easier to discuss UI artifacts since the environment's structure is more abstract.

Note that the first three layers aren't commonly thought to be the domain of designers at all; the last two are where designers are usually brought in. However, to be successful, designers should be conversant in all of the layers, and move effortlessly between them. The governance layer in particular has an important impact on the design of information environments. This is where business rules and processes live. It's essential that designers understand how the business works as a system and how that impacts their work.

In any case, understanding which layer we're acting on at any given time is key to being effective as change agents since all the layers require different approaches. Designers need to acknowledge that structural decisions are going to be a part of our information environments for longer than their user interfaces. If we expect these environments to last, we need to pay careful attention to their structural underpinnings.

Assessing Resilience

Often when we're in the midst of designing or operating an information environment, we can lose sight of the bigger picture it works within. It's especially difficult for teams internal to the organization to perceive the opportunities and shortcomings inherent in their evolving internal and external contexts.

Asking these questions can help you take a measure of the state of the environment and the degree to which it can evolve gracefully:

- Are there aspects of the environment that used to work and are no longer working as intended? How do you know?
- Do you have mechanisms to address those aspects of the environment that are no longer working? (How do you know when things are going wrong? What can you do about it?)
- Are there new requirements that the current environment doesn't serve?
- Has the context outside the environment changed?
- Has the context the environment creates changed?
- How do you know that these changes have happened? (Do you trust these sensing mechanisms?)
- Is everyone in the team clear on the original vision that drove the design of the environment?
- Is that original vision still relevant?
- Is this still a single environment? Or does it need to be broken up to pursue separate visions or strategies?
- What is the environment in service to?

What Is It In Service To?

This final question is of particular importance and worth pondering at length. The organization may have a stated vision of the sort of change it wants to effect in the world, but that is not necessarily what it or its information environments are really in service to. More obviously, there may be differences between what an organization

claims to be working towards, and the signals it sends as it goes about implementing its strategy. As always, actions speak louder than words.

Consider the case of Microsoft. From humble beginnings in the 1970s, the company rose to lead its field (and become one of the world's most valuable) in the 1990s on the strength of founder Bill Gates's vision of having "a computer on every desk and in every home." Microsoft's strategic moves and product-level decisions were in service to this vision, and it came close to achieving its vision with its Windows operating system. However, by the 2010s it was clear something had gone wrong. Most people didn't do their computing tasks on *desktops* anymore but using small mobile devices that didn't run Windows. Unable to see the changing ecosystem it was now operating in (CEO Steve Ballmer famously scoffed at the iPhone after its introduction) the company doubled down on its strategy by refusing to give non-Windows customers access to its key Office software suite. (While there was a version of Office available for Apple's Macintosh platform, Office for Mac was vastly inferior to its Windows counterpart.)

While still outwardly adhering to another vision, at this time Microsoft was actually in service to preserving the hegemony of the Windows operating system at all costs. And cost it did: market share (and mind share) kept eroding as customers sought alternatives to Microsoft products in their iPads and other mobile devices. In February 2014, Ballmer stepped down and a new CEO – Satya Nadella – took over. Nadella brought a new vision to the company, one centered on enabling customer productivity on a variety of devices and contexts, including those of competitors like Apple and Google. Shortly after Nadella took over, Microsoft released versions of Office for iPhones, iPads, and Android devices. Microsoft's products may never again regain the level of ubiquity they had during the company's heyday, but at least now they're available in the most relevant personal computing platforms of today.

These vision and strategy decisions have a substantial impact on the design of Microsoft's information environments. Office is an information environment which people experience in a variety of devices and contexts. In an internal email to colleagues, Nadella explained how he sees the company's products in a mobile-first world: "Our worldview for mobile-first is not just about the mobility of devices; it's centered on the mobility of *experiences* that, in turn, are *orchestrated by the cloud*." (Emphasis mine.) This statement hints at a direction for the structure and front-end design of Microsoft's customer-facing information environments. It calls for coherence across platforms in the front-end, and consistency in the back-end. This change in vision and strategy is manifest in the design of the products, with Microsoft touting the consistent experience users of products such as OneNote have when using diverse devices.⁷

So how do you determine what an information environment – and the organization that created and maintains it – is ultimately in service to? For commercial enterprises, the most reliable way I've found is to "follow the money": to examine the means by which the organization procures the resources necessary to operate and profit from its information environments. For example, I believe Apple is in service to creating excellent, desirable electronic devices that enhance people's lives. I believe this because the company's primary source of revenue is selling such devices to consumers. If Apple profited primarily from selling their customers' attention (by selling advertising, for example), it would focus on market penetration instead of quality. When I use one of Apple's information environments, such as *Apple Music*, I trust that my information and activities within the environment aren't employed in ways that compromise my

⁷ <https://blogs.office.com/en-us/2017/05/18/note-taking-made-easier-for-everyone-redesigning-onenote/>

privacy.⁸

Stewardship

As we've seen, information environments are complex systems. As with all systems, they must adapt to changing conditions within them, and in their broader contexts. In the best cases, this process allows these environments to continue serving their purposes for a long time. However, this best case is not a given. For an environment to evolve gracefully without compromising its purpose, it must be managed by stewards who understand the vision that led to the creation of the place and who have a clear understanding of the conditions inside and outside of the environment.

Let's return one last time to the Kimbell Art Museum. By the late 1980s, the Kimbell's art collection had outgrown Kahn's original design. In 1989, museum director Ted Pillsbury announced plans to expand the building by adding two wings to its north and south ends. This proposal triggered an outcry from the architectural community, which at this point regarded Kahn's building as a masterpiece. Eventually, the museum's leadership dropped plans to alter the building. Instead, they commissioned another celebrated architect – Renzo Piano, who worked with Kahn at one point – to create another building across from the original Kahn structure. This strategy honors Kahn's original vision⁹, and the new building acknowledges its celebrated

⁸ Apple has set out to differentiate itself from its competitors by taking an rigorous stance on issues of customer privacy and security. <https://www.nytimes.com/2016/02/21/technology/apple-sees-value-in-privacy-vow.html>

⁹ According to a group of prominent architects, Kahn argued that any new addition to the Kimbell should be in the form of a new building located across the lawn from the original building. <http://www.nytimes.com/1989/12/24/arts/l-kimbell-museum-in-praise-of-the-status-quo-384789.html>

predecessor by maintaining a similar structure and size, without mimicking it.¹⁰ The decision to expand by creating an entirely new environment is never an easy one. It takes conscious leadership to determine when it makes more sense to expand the existing place and when to break off and create a new one.

We've thus far been discussing buildings and architecture as a model for the structuring and organization of information environments. However, as with all models, this one falls short. Given physics doesn't encumber them, information environments can be much more dynamic and organic than buildings. Because of this, we will now examine stewardship of information environments more closely by adopting as a model another type of human designed environment: the garden.

¹⁰ Piano has stated that the new building is "close enough for a conversation, not too close and not too far away." <https://www.kimbellart.org/architecture/piano-pavilion>