

Designing (for) the Invisible: Finding Overtone in Designing a Digital City as a Computing Platform

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What makes the sound of Stradivarius so rich? What gives each person's voice unique quality and color? How can music carry so much more than mere melody, touching deepest part of human emotion and bringing up the best and worst of human experiences?

Much of the secret in human experiences with sound comes from the part that we often cannot hear – overtone. When an instrument plays a tone, its sound is not a single tone. Instead, the sound we hear with our ears is a composite of multiple tones. Our ears tune into what is called fundamental tone – lowest tone of the series of tones that is generated by the instrument and the player. The fundamental tone – which is the most “visible” to the listener – determines the pitch of the sound. However, the different combination of overtone waves is the one that determine the quality of sound – timbre. The material and structure of instruments, the way player physically contacts the instrument, and the shape of the room affect the initial distribution of waveforms of fundamental tone and its overtones. The dynamic interplay between these overtones further enriches the sound quality. This is why, the beautiful and eloquent A sound of cello sounds so different from the same A of violin both played at 440Hz. Overtone also explains the differences between two violins. In fact, police often use the overtone patterns to trace lost instruments, as if overtone structure is the fingerprint of an instrument. What makes the difference is not what we hear, but what we often don't hear. The overtone and how it is produced gives musicians never-ending possibility of making different sound. This is also how composers of classic music keenly, albeit implicitly, understood. Although the existence of overtone was theorized first by Pythagoras, it wasn't until about a hundred years ago the precise nature of overtone was finally discovered by the work of a German physicist, Hermann Ludwig Ferdinand von Helmholt. Nowadays, anyone who has access to sound spectrum analyzer can easily visualize the existence of “invisible” parts of the sound.

The presence of overtone, and its important role in shaping the richness and the color of sound, is one of the reasons why digital sound is different from natural analog sounds. A certain range of overtones is often lost in the production of CD or MP3 files. That is why digital instruments often sounds so “boring” and “flat”. Often, cheap digital sounds focus only the most visible part of a sound – fundamental tone. The more we add overtones to the digital sampling of a sound, the richer and the more realistic the sound becomes.

The idea of overtone can be an important principle for positive design as we attempt to apply digital technologies to solve urban challenges. How can we use emerging digital technology in order to make cities a better place to live? How can positive design make our lived experiences in urban environments richer and more vibrant? The primary role of designers, I believe, is to identify the overtone of the place and bring them into the digital realm. We often think design in terms of what we see and hear. But the real power of design is to consider what we don't see

and hear and bring them to bear as they design what we see, touch and hear. Just as if, a good composer must think about the differences between the sound of A from a cello and a violin, which primarily come from the differences in overtone, a design must go beyond what seems to be the primary pitch of the objects or services that she is designing. What, then, does it mean to consider the overtone in positive design? Let me consider three possible aspects, weaving some examples from the *digital city as a computing platform* as a design vision that are designed to produce positive outcomes. Let me first introduce the notion of digital city as a computing platform.

By digital city as a computing platform, we refer to a new reality of computing that is experienced in and through the material reality of urban environments. The goal of the new computing paradigm is not to represent the material world, but to create a better world in which we live. The computing experiences are created, stored, actuated and experienced not only through conventional “computing” tools, but also by actors, ordinary artifacts, and places. We no longer experience computing as something that is out there in this new digital urban environment, but rather we live *in* it. We all become part of large computing system in a city. To put it simply, the city with all its people, objects and buildings *is* a computer. With the layer of digital information infrastructure that supports ubiquitous computing environments implemented over the physical environments of a city, a digital city is a prime example a radically convergent digital environment. In a digital city, individuals and groups do not simply use computers in a traditional sense, but they *become* a part of large, complex, organic computing systems. A digital city as computing platform then consists of individuals with various forms of mobile devices with global position system (GPS) capabilities, vehicles with mobile platforms, street signs and objects (such as historic landmarks, benches, bus stops, etc) on the street with digital tags, buildings, and traditional forms of computers. Together, a digital city produces and consumes location- and time-sensitive data that can be created, stored, tracked, processed, associated and re-mixed in order to augment and transform ordinary everyday life experiences. A digital city as an open computing platform then can be a platform that mobilizes distributed intelligence in order to address pressing social, economic, cultural and technological challenges that modern cities face. As a consequence, the realization of a digital city as an open innovation platform will lead to a stronger, healthier and more vibrant local community (Putnam 2000). In the same way that open source communities and the social media sites like Wikipedia are encouraging users to participate in an open innovation process, one can expect the digital city will be effective in inducing civic actions by residents, commuters and visitors in the city to address common urban challenges.

How then can we consider overtone in designing a digital city?

First, in positive design, to consider overtone means to consider what used to be ignored. They are the social groups that are often neglected and disenfranchised. Not only it means their voices are heard and reflected in the design, but they are recognized and celebrated as primary source of richness of the design process and outcomes. Designers from IDEO often seek extreme users in order to gain hidden insights – hearing the overtone. Residents of inner city districts, faced with poverty, drug dealing, crime, and discrimination are extreme users. Their voices are

often unheard and unnoticed, but they are always there. They are overtones of the city. A design of a digital city should capture their voices.

Second, overtone implies multiplicity of narratives of urban environments. For example, there are many buildings, landmarks, and other artifacts in the city. Each of these places in the digital space has an *official* narrative. The use of digital tools and the construction of a digital city affords an opportunity to change this by allowing information to be commuted *from inside to outside*, placing data in its particular context promotes the use of urban public space and supports urban public life. Data can be graphic and written – a map, a photo, and written text could all be retrieved to augment an experience. Data that is retrievable from many venues offers the opportunity for more extensive use. Through such implementation, a digital city platform presents the opportunity for formal and informal information to coexist, thus supplementing the urban experience. Informal information considers the voice of the public – overtone of the place. Official narratives alongside the voice of the public are supportive of a democratic ideal. Here, urban public space and the city experience are greatly enhanced using digital media. In a digital city, it is possible for representational and imagined realms to remain hidden in the context. However, when individuals use the device to access these layers, information can open up the world of information and the physical realm would remain unadulterated.

Finally, overtone implies the background context. In the context of a digital city, the material and social worlds make up the background. Unlike previous computing technologies, a digital city must be designed in the backdrop of material and social worlds of existing urban environments.

These three aspects provide an initial step toward recognizing overtone of the design of a digital city as a computing platform. The use of digital information infrastructure can be used to pay closer attentions to the previously invisible realms of urban experiences. Overtone of a digital city creates rich and vibrant tone quality of experiences in a digital city, just as overtones produce unique voices and color to different instruments.