The Future of Outdoor Media Systems

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American cities are run by mayors, city managers, and councils who are endeavoring to reduce energy costs, provide enhanced public safety, and improve their communities, all with reduced revenue streams. It seems an impossible task. Adding to this challenge, the U.S. form of civic government has been divided or partitioned into segments to distribute tasks toward experts in their fields. These divisions compete regularly for funding, creating a never ending and sometimes politically charged situation.

The police and fire chiefs run the public safety areas along with road commissioners who try to give their officers fast access to information. Environmental planners and water resource commissioners deal with water, earth, and air quality and are always in need of much more data to monitor and control their systems. Public lighting is concerned with keeping the lights on, paying for the energy, and maintaining vast amounts of equipment. Any major U.S. city has between 50 000 and 200 000 lights. Lights have several components besides the lightbulb, which triple the repair and replacement needs. Therefore, there has been a major focus on wireless methods of monitoring lighting maintenance requirements.

Acquiring data is expensive; making sense out of the data and creating an action once data is validated is even more expensive. The cost of improving our infrastructure in these areas, coupled with the high cost of energy, has caused governments to look towards energy conservation to help pay for improvements, in addition to paying for current overhead and debt.

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Since cities in general are focused on reducing their energy consumption, one of the largest areas of conservation has been through improved light emitting diode (LED) street lighting. LEDs promise to cut energy consumption for lighting by least 40% from current levels, and pay back the cost of new installations over a reasonable time. Additionally, the notion of controlling the new street light's output through wireless controls, monitor when lights are out, and save additional energy by dimming "after hours" is being tested or deployed to varying degrees of success. When well thought out and deployed, wireless street lighting controllers can save up to 30% more energy than simple on-off systems. Coupled with a good LED light engine (light source), a controllable, dimmable wireless system can save up to 70% of the current energy used by the old systems. This has caused a bit of a flurry of activity from some cities to test the feasibility of wireless controls.

Concomitantly, police, fire, Homeland Security, and environmental agencies are installing wireless methods of gathering information for their own purposes, such as cameras and gunshot detection. In most cases, each unique system is developed with its own software and wireless network with no notion of interoperability. Interoperability is a fancy word for the ability of computer and mechanical systems to talk to each other and provide a common operating platform. Imagine that each city is deploying its own information networks independently of the cities next to them; each county is doing the same, and each state – likewise. What a growing mess such haphazard growth will create. Under Britishrule in India, the English language was forced onto the Indian population that spoke more than 100 languages at the time of occupation. Ironically, if not

for a common language, India would never have come together to be the great country that it is today. Have you ever wondered about pilots flying into foreign countries? Again, the common language, at least for international and transcontinental flights, is English.

Why then are we not looking for more common operating systems for our cities to communicate with each other and ultimately with the national government? Is not one of the U.S.'s most important strengths the federal highway system? Why then not a digital highway?

Now that this entire information gathering effort is afoot, to what end will it be used and how will it help the population? Large banks of computers or cloud based systems are being deployed to store and make sense out of the data. Analysis occurs via custom software unique to each system and companies like IBM create software to help officials understand the implications of what has been gathered. Then what? If there is an accident, a fire, a water-main break, a gunshot, or a terrorist threat – how will the people in their cars and on the streets benefit from this information?

Why don't we just start over? Let's look at the big picture. We need to deploy information gathering systems that are "smart", not just eyes and ears and noses, but systems that can make sense out of the data right where it is collected. Moreover, a system is needed that can react with audio, video/visual, and directional information to alert motorists and pedestrians within milliseconds. We need a system that essentially does it all, in one platform, as easily as using an iPhone or iPad, and that is flexible for future growth. It would seem like one system would also be far less expensive than four: less maintenance, less energy to operate, common parts, and easier replacement.

Next, a system is needed that finally deals with mass notification. Simply, we need a system that talks to us when we need help, or when we need to be warned. Those that say iPhones are becoming that solution are partially correct, assuming that people sign up for notification services, can hear their phones ring in a hurricane or during a fire, and are able to answer the phone! Nothing takes the place of a simple speaker. Not just one, but everywhere. Not one that barks from the top of a forty story building, but one that can talk to you from a whisper to a shout and one that is always near you. These need to be located as frequently as are street poles and lights, usually every 100 feet or so, with a mass notification system embedded securely and hidden within the light or the pole – which seems the most logical place.

Stadiums and arenas can have as many as 100 000 people leaving at once. In a real emergency, how do people know where to go for safety? Can they be directed with signage? Certainly, paper and vinyl signs will not work, but digital LED signs/banners coupled with voice communication through a mass notification system would be ideal. On street lights indicator beaconscould be used to direct traffic.

Emergencies are predictable, but where and when they happen is not. Flexibility then becomes the key to emergency management. Some cities have what used to be called "air raid sirens," today we think of them as bad weather alerts. These alerts cause us to look up in the sky and essentially guess what and where the problem may be coming from.

Let's elevate the issue of city management to state management and ultimately to government Homeland Security and the national grids. Either refineries, energy plants, pipelines, ports, border crossings, government buildings, stadiums, or financial districts exist in every state in the U.S. (and in most countries for that matter.) The U.S. Constitution requires that the federal government protect its citizens. Now imagine the reality of all states, counties, and cities that manage their own software, hardware, and data collection systems with little or no guidelines for interoperability. You end up with a hundred languages, data that may not be useful, and almost no ability to talk back to citizens in a meaningful way, except for TV and radio – assuming they are working.

We are now just beginning to see the capability of wireless controls and data collection systems. Now is the time to look into common operating platforms (COPs) to truly gather all the information possible from outside (and even inside) environments, send it back home in a meaningful way, and create a "talk back system" that informs the public. It's time to stop working in partitioned methodologies and develop one economical outdoor media network. Among the ways that this is economically feasible is through community messaging and advertising models. Done properly, the mass notification system can double as a radio playback method; national public radio (NPR) for the streets, ports, and parks. Digital banners can inform people of anything – from where to park and shop to a "drink Coke" advertisement. Done in an aesthetically pleasing way, digital sign revenue can create an income stream that not only pays for a new outdoor media system, but will create substantial recurring revenue. Further, if we have one common system, cities can use the aggregate cost of three to four systems and surely save dearly needed assets.

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of knowledge around this and other theories that engineers could draw on to inform design. Although multiple theories of wellbeing describe autonomy as critical, technologists frequently privilege automation which can leave users frustrated and helpless (as Don Norman thoroughly illustrates in *The Design of Future Things* [9]). When designers and developers draw on a sophisticated understanding of wellbeing, benefits to the user experience must surely follow.

In other areas, virtual environments have been shown to have a significant impact on "helping behaviors" [see the Stanford study of altruism for example [10]] or to "promote an awareness of attention during cognitive training" [11]. Our own work with the Young and Well Cooperative Research Centre looks at supporting wellbeing in young people via the Internet. The list of examples in the category of "dedicated" positive computing is already long. But the impact of the tools in this category is limited to those in the population willing to seek them out and use them. The greatest potential will be reached when our day-to-day technological experience is guided by consideration for our human flourishing—when even companies like Microsoft, Facebook, and Apple are evaluating how their products affect psychological wellbeing as part of the iterative design cycle. We are inspired by a vision of the future in which computing professionals contribute to a rigorous and dynamic interdisciplinary effort towards digital experience that is deeply human-centered.

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OPINION

Why has this not been done already? The answer lies in the way cities do business. If you want to build something, you hire and engineer and architect. If you want to secure an area, you hire a security expert. If you want to remodel a downtown area, you hire urban designers. If you need new street lights, you call the utility. Who would champion such a ubiquitous system? It has to begin with mayors and city managers, county executives, governors, and the U.S. Department of Homeland Security. Once a model has been established it becomes far easier for others to follow.

Let us all hope that we figure out how to save money by avoiding so many wireless platforms and develop a common operating methodology that takes us far into the future – before it's too late. This is not about Big Brother, it is about the reality of urban populations developing a means to monitor and control their environment, reduce chaos in the event of a disaster, and do so with a day to day system that provides an informed and enlivened community.

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