Design, Development, and the Invisible Medium: What Canada can learn from a communications revolution taking place in the developing world

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Gilbert Vanburen Wilkes IV, PhD
Royal Roads University

Introduction: states, development, and design

Development popularly construed reduces to the development of a state. In the arguments of commentators and policy elites, the elements of development—e.g. school buildings, clinics, potable water, electrification, distribution networks like roads or rails—are all set in the frame of a developing state.

For example, both P. Dufour in his *Canadian Foreign Policy* article titled "New Paths to Knowledge, Innovation and Development: Canadian Leadership in Emerging Global Partnerships,"and W.F. Birdsall in his "New Paths to Knowledge, Innovation and Development: Canadian Leadership in Emerging Global Partnerships" link Information and Communications Technology (ICT) development at home or abroad—the closing of the digital divide—with the nation state. Dufour argues that the "digital divide, the genomics gap, and the knowledge gap" are all "buzzwords designed to instil a sense of urgency" in attempts to address gaps in "significant funding" and "strategic approaches" between developed and developing countries. Further: Developing countries will require a "basic capacity in skills, governance, institutions, and emerging technologies" to be able to "negotiate technical cooperation agreements and global partnerships" . Similarly, Birdsall, in his "Digital Divide in the Liberal State: A Canadian Perspective," argues that the term "digital divide" reduces to an administrative issue the larger goal of universal access to information services. Further: without a commitment to universality from the state, there will always be a digital divide in Canada. This, argues Birdsall, is because it is inherent to North American Liberal public philosophy, a philosophy based on market

values as opposed to social solidarity . Birdsall in particular argues that market centered policies favour private solutions at the expense of universal access.

But design solutions to the digital divide have emerged that make no assumptions about whether, or in what condition, a nation state, or its presumed infrastructures, exist at all. These solutions can allow a developing society to leapfrog to a higher general level of technical competence by resolving in advance infrastructure, support, and other issues. These are systems and services that require minimal capital infrastructure, minimal training or technique to maintain. These are systems that can help relieve social or material divisions to the degree that they allow access to core, boundary-spanning networks such as international telephone exchanges or the internet.

On a practical level these solutions open up new possibilities for pursuing development goals in Canada and abroad. They also open up new possibilities for pursuing diplomatic goals, particularly with respect to public diplomacy and policy formation both domestically and aboard.

On a theoretical level, however, these solutions challenge the premises from which the development community draws its conclusions about the historical tasks of telecommunication networks and information technologies.

Policy and Design

Design is policy. For example, with respect to the design of cities, it may be argued that promoting the ownership of automobiles over systems of mass transit (e.g. to stimulate consumer spending on automobiles or suburban homes), disaggregates urban concentrations on grounds of class and ethnicity at home—white flight, suburban sprawl—and complicates sensitive geopolitical relationships by developing, abroad, key-resource extraction economies, and the disparities of wealth and class that occasion them.

But while it can be said that design *is* policy, it does not follow that policy *is* design, or that principles of design can be deduced or inferred from policy priorities, or that policy should even speak directly to design. Policy is about who gets what, and what goals a polity pursues, for example: security. So it is not enough to lecture the designers of systems about civic virtue, or, on the other hand, to accept uncritically what the designers of systems or researchers offer to enrich the lives of peoples at home or of peoples abroad. What is required instead is policy-informed-by-design, policy grounded in both the practical and the probable *as it specifies itself in design solutions*. As an example of this sort of analysis, I compare two design solutions developed to address the digital divide, with respect to their policy implications.

At the moment there exist many design solutions that attempt address the digital divide. Examples include India's Simputer or Mobilis, the Microsoft cell phone (in prototype), Hewlett Packard's 441 system (discontinued), Brazil's Linux desktop, the EELs system in Kenya. All of these solutions share one of two pedigrees. They are either attempts to (a) make laptops, desktops, or handhelds cheaper and more robust; or (b) attempts to make cell phones more powerful, more capable, and more usable. The paradigmatic instance of (a) would probably be MIT Media Lab founder, Negroponte's US$100.00 laptop; the paradigmatic instance of (b) would be the wireless device solutions already circulating. The analysis offered here will focus on these two design solutions to the digital divide.

Both design solutions seek to be as inexpensive, lightweight, robust, and as durable as possible; both are designed to address social issues using technical means; both offer opportunities for indigenization and local adaptation. But both seek to pursue these goals in different ways and for different reasons. This is because the two design regimes are organized around very different core assumptions. Some of these assumptions operate at the level of states and NGOs, markets and civil society. Others operate at the level of infrastructure and technological development itself. Some are explicit, others more implicit.

k-Phase Design: One Laptop Per Child's US$100.00 Laptop

One Laptop Per Child (OLPC) US$100.00 laptop is designed to operate in straitened conditions. For example, it can operate using standard flashlight batteries, or by using a power cord that doubles as a shoulder strap, or it can even operate by turning a hand-crank to provide power where batteries or a continuous supply of electricity is unavailable. The brightly coloured machines will also support mesh-networking, which means that the devices, if within a certain range, can network themselves together wirelessly even in the absence of wireless transmission or a local broadband signal. The aggressively non-commercial, non-proprietary character of the device requires licensing partnerships, price schedules based on distribution, subsidies from governments and donors and manufacturers; it also requires that the device be manufactured in lots of a million or more to keep the price at or near US$100.00 . With mass distribution planned in Brazil, India, and China, Negroponte's One Laptop Per Child operates at a scale that requires coordination through nation-states and large corporations.

How the device integrates itself into existing programs of development or intervention is clear. Negroponte's laptop, is targeted to children to support education and educational outreach. The marginal rate of return on investment for early generalized education is far higher than for later, highly specialized education . Negroponte's own rationale for distributing the device, at least as reported in the popular press, is simple bordering on trivial. Give these machines to children, children in even the "poorest part of a developing country," and they will use them. "The speed with which [a] child will acquire the knowledge to use the device is so astonishing, you risk thinking it is genetic," Negroponte is quoted as saying to Ian Limbach in an article titled "Waking up to a Laptop Revolution" . This has been the experience of many researchers , as well as parents and educators, at least in the West: children and young people tend to acquire computer skills quickly, especially using certain sorts of applications, e.g. video games, and it is a game that Negroponte elects to use in his analogy.

Ownership is the essential premise of Negroponte's plan. The children themselves must own the machines. "Give each child a pencil and the child then uses it to draw, to write, at school, at home, for play, for study, for making music by beating it, and on and on. Likewise the laptop," Negroponte is quoted as saying to Ian Limbach . Why personal ownership would necessarily outperform shared or communal ICT resources is, on its face, unclear. But, again, Negroponte's claims are consonant with the experience of young people reared in the post-war consumer societies of the West. This particular claim is probably consonant with Negroponte's personal experience. Negroponte, born in 1943, is two years short of being a US "baby boomer" (the post-war demographic cohort), a generation that marked itself in contradistinction to past US generations, socially, materially, even digitally. Hence in his claims he seems to link generational transformation to development. But the laptop is merely the instrument; the empowerment occasioned by ownership which passes into appropriation is the process. This is a theory of development at least consistent with cultural and historical experience in the West. In the same article by Limbach, Meles Zenawi, prime minister of Ethiopia, outlines his plans to bring telephony and wireless broadband to "nearly every village in Ethiopia" . At the time of writing there was little traffic on Ethiopia's "multi-gigabit backbone network," according to Limbach; it is hoped that Negroponte's laptops will help increase the load .

In the terms of its design, Negroponte's laptop is an example of a closed artefact; its production, distribution, even its form and its shape bear all the marks of a closed artefact. What does this mean? Pinch and Bijker, in their book chapter "Social construction of facts and artifacts: or how the sociology of science and the sociology of technology might benefit each other," argue that technological artefacts, when they enter the world, tend to do so in various and different forms . The artefact itself enters the world to solve or to address a problem. The different forms represent answers to that problem proposed by stakeholders, users, designers and so forth. Once a critical mass of use gathers around a particular form or forms, the artefact achieves some degree of closure and the problem, as it was articulated at the time, disappears. Pinch and Bijkers example is the form of the bicycle, which enters the world in many various forms, e.g. the

"penny farthing," the "boneshaker," the "whippet spring frame" . About 100 years ago the form closed around the standard bicycle that anyone would recognize today. Revolutions in use and the demographics of use, as well as revolutions in materials and production—all of these, over the past 100 years, have failed to significantly alter the familiar form and shape of the bicycle.

Personal computers developed similarly. There were Altairs, Kaypros, Osbornes, Sinclairs, Apples and Apple IIs. Some were designed for hobbyists or enthusiasts; others were designed more for business applications. In the early 1980s the personal computer began to close around two distinct forms, the Apple Lisa, the first personal computer that featured a graphic user interface, which became the Apple MacIntosh, and the IBM XT and later AT machines. Revolutions in networking and applications, revolutions in processors and the production of processors, revolutions in power, performance, and cost—all of these, over the past 20 years, have failed to significantly alter the form of the personal computer, which remains an output device in the form of a monitor, an input device in the form of a keyboard, a mouse, or a joystick, connected to a processor and storage media, a system networked to the world using TCP/IP, and using one of only a few operating systems. Negroponte's laptop is a part of that development, an artefact within that development; like bicycles or automobiles, it is a closed artefact.

Closed forms are also marked by declining marginal rates of return on further development, improvements, updates, and upgrades. The marginal rate of return on investment declines because in any problem solving enterprise (e.g. science, engineering) the easy problems get solved first; what gets left are problems that are more an more costly to resolve . Consider the famous "Moore's law," the up-until-now successful prediction by Intel co-founder Gordon Moore that about every two years the number of transistors on a chip would double even as the prices for the chips crashed. Moore's law continues apace, but at higher and higher costs for research and development (R&D) at decreasing marginal rates of return for every dollar invested. For example: Kanellos writing for CNET News.com reports that Princeton Professor Chou's "imprint lithography" technique can create "features on a chip measuring 6 nanometers," an

impressive achievement. Kanellos goes on to write that "Around 2023 [if Moore's law continues apace], the source and drain [components of a transistor that must be kept separate] will be so close [on the chip] that electrons will travel freely between the two and corrupt data unless major changes are made in chip manufacturing techniques, design and materials" . In other words, a revolutionary as opposed to evolutionary step will be necessary for any forward motion to take place. The point: smaller improvements are getting harder to develop, and at a steeply declining marginal rate of return on every euro, dollar, yen, or rupee invested.

The transition from a state of variation to one of closure resembles the transition r- to k-phase described in accounts of ecological systems. In an r-phase (or exploitation phase) relatively high gain resources are suddenly available. In an environment this could be because of a disruption, e.g. a massive die-off in a lake. In a human system this could be because of a new energy source, e.g. petroleum, or a technological breakthrough, e.g. the silicon chip. r-Phase organization is marked by opportunistic or entrepreneurial organisms that only loosely cohere together. Hence the variation, e.g. the Kaypros, Osborns, Sinclairs, and Apple IIs. r-Phase transitions into k-phase (or conservation phase) organization as competition for resources becomes more intense. Hence, a resource base may become depleted, so more effort must be expended for less return. This may take the form of more and more effort being expended to imprint more transistors on a chip, or plans to suck oil out of tar sand in Alberta. Or it may take the form of more intense competition for consumer dollars. This competition combined with declining marginal returns results in more organization, more differentiation, more hierarchy, and more integration as declining resources must be used more efficiently, even as the effort expended to get those resources must also continue to increase. The desktop or laptop computer is a k-phase form because (a) it represents the accumulated capital of a long process of competitive development, because (b) it has closed around a standard form in the course of that development, and (c) because of a declining marginal rate of return on its continued development (e.g. Moore's law).

Negroponte's laptop is a *k*-phase artefact adapted to the straitened conditions of the developing world—its form is set, settled, complete as it stands—the argument is over. The form is not meant to change or to alter in anyway; it is insulated from the conditioning of the market. For it to alter or develop at all would undermine the US$100.00-a-unit cost-structure by adding the expenses of further development. Further development would probably also upset industry partners who would prefer not to subsidize a potential competitor. Significantly, Negroponte expects his *users*—the children in e.g. "the poorest part of a developing country"—to change as they use his device . The tool is not meant to change, adapt, transform, grow, develop; its users, however, are. Significantly, Negroponte has positioned himself as a *k*-phase actor. He operates as an anti-entrepreneur; a consolidator, a partnership developer, what in the not-for-profit or NGO sector passes for mergers-and-acquisitions. He approaches design problems like General Motors or IBM, and at similar scales of production. Negroponte's strategy is to recruit industry partners and negotiate with governments and NGOs. This is conservation phase organization, production, and distribution, but in pursuit of the *r*-phase goals of transformation and opportunities that can cause instability.

_r_-Phase Design: Wireless Communications in the Developing World

Negroponte's laptop enters the world when wireless internet devices are growing smaller and cheaper and dispersing themselves into any number of forms.
Some of these forms themselves resemble desktops or laptops—so-called palmtops—and are meant to emulate the form and function of their larger predecessors. Others are simply cellular phones that have accumulated features, processing power, and allow access to the services of the internet. These forms are for the most part under-powered and under-developed when compared to desk-tops and even to Negroponte's laptop. But they are often cheaper, and in some parts of the world, far more abundant.
The variation in the number of devices, kinds of devices, designs of the various kinds of devices, and the features the devices offer, suggests an *r*-phase organization of production. Wireless devices constitute a technology, or a family of technologies, that has

yet to achieve closure; this is a technology where the stakeholders have yet to reach any firm conclusions. They are still developing and testing possibilities.

The technology's stakeholders—users, consumers, infrastructure developers, retailers, service providers—are located in, and all across, the developing world as well as the rest of the world. The technology is also transitioning from a so-called second generation (2G) to a third (3G); 2G wireless developments include digital voice encoding, packet routing, increased bandwidth, and multimedia; 3G wireless developments includes greater media integration as the devices, supported by greater bandwidth, can now be used as cellular phones, media servers (audio or video capture or conferencing), faxes, pagers, web browsers and so forth.

3G wireless communications also opens up the possibility of context sensitivity or location awareness. This means that the device—the cell phone or handheld—knows where it is. This means that the device can be used for navigation, for accessing information that is linked to location, for social networking, or for collaborating remotely with others. Location awareness can allow developers of information to create an information overlay over a hospital, a campus, or a city; the device could tell the user where she is, what services are available around her, and allow her to access instructions for the procedures necessary to call on those services. Location awareness holds out promise for relieving the relative anonymity of urban concentrations (by creating navigable, intelligible spaces) and the relative isolation of rural environments (by allowing social networking and collaboration in space).

2G wireless communications have already deeply penetrated the developing world. An example of a wireless communications technology adapting itself to conditions of use in the developing world would be Motorola's C116. The device was developed specifically for "emerging markets," i.e. areas with no wired or wireless infrastructure, at a relatively affordable price. According to one reviewer, this device outperforms devices available in North America, and for precisely the same reasons that make the device attractive to users in emerging markets . Whether this particular device thrives or fails in those

markets is an open question. But the point remains: the demand exists in critically underserved areas, this demand has been acknowledged across geographical, political, and ethnic boundaries, and *r*-phase actors (e.g. researchers, developers, designers, combined with venture and entrepreneurial capital) are attempting to address it with various solutions. As the Washington Post reports, the growth markets for cell phones and other devices is Africa . This is where the *r*-phase investment is flowing; this is the region experiencing the most growth in devices distributed and services provided.

Can wireless technologies support development in a conventional sense? With Negroponte's laptop the answer is clear: it is a *k*-phase that enters the world complete with years and years of accumulated usability studies, technical expertise, and curricular development that can support its use as a pedagogical tool in homes and classrooms. With Negroponte's laptop, the accumulated capital of a networked world waits to be accessed. But cellular phones—even the more advanced, 3G devices—usually have keypads instead of keyboards, maddeningly tiny screens, and less processing power. Yet the answer appears to be yes, cell phones can support development.

The accounts that link wireless to development that appear in the popular media are based on two arguments. The first and more common argument—an argument grounded in the often proprietary research that gets cited to support it—follows this line of reasoning: goods and markets in the developing world are difficult to find, difficult to connect. Someone has a good. How does she find a market where the best price is offered? Rather than guess or gamble, she uses her cell phone. This both cuts risk and adds efficiency to the system as pockets of scarcity get targeted by wily entrepreneurs who benefit from the price arbitrage. This raises the productivity of capital and labour: less input, more yield; profits rise, prices fall. In the absence of any other infrastructure, relatively inexpensive cell phones make this possible. This is the account reported in an article in *The Economist* . The account is redolent of the Efficient Market Hypothesis (EMH), the notion that markets tend toward maximum efficiency as market actors attempt to maximize benefits to themselves on rational grounds. *The Economist* article reports on research by Robert Jenson to be published in August 2007 in the *Quarterly Journal of Economics*. The

article concludes by quoting Jensen's claim that development supported by cell phones requires no investment by governments. All that is required is that "governments … issue licences to operators, establish a clear and transparent regulatory framework and then wait for the phones to work their economic magic" .

The second argument is the more interesting argument in that it inverts the relationship of the developing to the developed. This account holds that it is that it is the very backwardness of emerging markets in the developing world that drives innovations in wireless services that are rare or do not exist in developed countries. So reasons Foster for the Associated Press in an article titled "Cell Phones Vital in Developing World." His examples include cash transfer and purchasing services using cell phones in the Philippines . The argument naïvely reviews Trotsky's Law of Uneven and Combined Development, described in his *History of the Russian Revolution*. This is the notion that less developed political or social communities can appropriate the tools and techniques of their more developed peers without passing through the historical stages that produced those tools or techniques. What Trotsky calls the "privilege of backwardness" allows developing communities to adopt the most advanced available solutions unencumbered by the weight of legacy capital . According to this narrative it is because of the developed world's massive investments in road, rail, electrification, air travel, broadcast media, and telephone exchanges linked by fixed landlines that development in low-cost, light-weight, and low-power solutions like 3G wireless communications have lagged behind some areas of the developing world. In other words, the developed world itself has entered a *k*-phase in many sectors; the possibilities for *r*-phase innovation have transferred to the developing world. It is this argument that journalists and researchers have yet to pursue to its conclusion: what, the question now becomes, would be the social and historical effects of this global technology transfer? In Trotsky's account of development, all development is uneven development where the advanced and the archaic combine to produce syncretic social and political forms, some progressive, others patently—even painfully—less so .

This combined and variable effect, I argue, can be found in the changing character of global conflict.

Wireless Communications and Global Conflict

Significantly, 2G and 3G wireless can cross boundaries of literacy and language because they depend largely on the spoken word. They can also span other boundaries, boundaries that theorists and researchers tend to pass over, boundaries like war, low-intensity conflict, or the complete collapse of a state and all its services. In cities like Mogadishu and the war-torn Congo region, telecoms function successfully often in the absence of a state . (How policy planners, NGOs, and aid agencies can emulate or capitalize on this success, or leverage the already existing wireless infrastructures of the developing world to support more targeted social goals, remains an open question.)

Wireless technologies are already credited with social and political change in North America. Changes in social networking among children and adolescents might be one kind of example. Another kind of example would be protests organized against the 1999 Ministerial Conference of the World Trade Organization, known as the Battle of Seattle. The protestors, using off-the-shelf 2G cell phones, were able to out-organize and out-maneuver a superbly equipped coalition of police departments with US federal police support . French rioters organized themselves similarly in 2005 with even more success .

Changes are occurring elsewhere too. As early as 1995 it is reported that Chechyan rebels used "Motorola and Nokia cellular radios" to coordinate mobile units during the Battle of Grozny; their light, agile, irregular formations significantly outperformed their Russian counterparts who used conventional military radios, devices ill-adapted for use in the concrete canyons of an urban terrain **.** Compare the Battle of Grozny with The Battle of the Black Sea, which occurred only 3 years earlier. This was the rescue operation mounted by US forces when a Black Hawk helicopter was shot down in Mogadishu. The Habr Gidr clan militia and their supporters organized their ambushes based on military sectors that communicated using a "crude radio network" . As dramatized in Ridley Scott's film *Black Hawk Down*, the Battle of the Black Sea was a tactical success on the grounds that the US rangers completed their mission and extracted the hostages. The

operation was a strategic failure for the US on the grounds that the US withdrew from Somalia . The Battle of the Black Sea foreshadowed the Battle of Grozny and the Battle for Seattle. One of the differences between the Battle of Grozny and the Battle of the Black Sea—two battles in which lightly armed irregular formations used swarm tactics against conventional forces—was the quality of communications used by the irregulars.

Consider also the Christian, Druze, and Sunni protest mobilization in Lebanon, beginning in February of 2005 with the assassination of former Prime Minister Rafik Hariri, a mobilization for change that the US State Department called the "Cedar Revolution," a riff on Vaclav Havel's Velvet Revolution in Hungary. The mass mobilization is said to have begun with a satirical text message distributed on Beirut's "famously ubiquitous cell phones" . Also: consider the Shiite counter-demonstration that dwarfed the Cedar demonstrations but were underreported in the West. In August 2006, 3 weeks into Israel's Operation Change of Direction—what appeared to be a reprise Israel's 1996 Operation Grapes of Wrath—the Israelis were already reported to have targeted not just the television towers for Hezbollah's *Al-Manar* broadcasts in Lebanon, but their cellular telephone towers as well. Captain Jacob Dallal, an Israeli army spokesman, is quoted by the Associated Press claiming that cellular phones are a "'key communications link' for the guerrillas" .

Combine the rapid urbanization of the developing world with the rapid diffusion of wireless technologies and the question becomes *how many Cedar Revolutions or Battles for Seattle have already been fought and won, or lost, or fought without reaching a conclusion, or that are still ongoing, that are completely unknown in the developed world?* What sorts of new modes or methods of social organization, in the form of trends that unfold over time, can or could emerge in Africa, India, China, or elsewhere? What sorts of new or novel social or political successes, failures, alignments, resistances, rebellions, or revolutions can or could emerge, and how should the developed world respond? What about events that are known and widely discussed in the West? Consider Bin Laden's escape from Tora Bora. Consider the failure of US Marine Operation Valiant Resolve at Fallujah in 2004. Consider the battle for Jenin in 2002. Consider the current

Taliban operations in the south of Afghanistan. Consider the current, cross-border operations of the Janjaweed militias in Sudan. Consider the operations of the Islamic Courts in Somolia. Consider the establishment of the Islamic Emirate of Gaza. Consider the developing operations of the insurgency in Iraq or Afghanistan. How, and in what ways, are these developments linked to the diffusion of simple and cheap wireless capabilities?

Groups engaged in struggle will tend to imitate or appropriate whatever another group uses to its advantage, or they will develop countermeasures. Hence, conflict tends to be a strong driver, and a good predictor, for the adoption and diffusion of technologies and the techniques that groups develop to use them effectively. But this diffusion and adoption develops itself in different ways under different conditions.

Peer polities locked in relations of competition tend to develop higher levels of complexity, with all of the attending costs, until one or more of the competitor polities collapses . An example would be The Cold War or The Great Game.

When the relations between competitors are more asymmetrical, however, the opposite occurs: the more complex and sophisticated players tend to regress . Hence, the ordinary costs of counterinsurgency operations tend to include crime, atrocities, and, in the long term, moral and organizational disintegration. At an operational level this suggests that armed, networked, relatively autonomous cells may be the future of Western forces too. This is what the Law of Uneven and Combined Development would predict.

Conclusion: Exploring the possibilities of the two design regimes

Dufour would promote development abroad through a strategy premised on Canadian leadership in emerging global partnerships . An almost ideal opportunity for Canadian participation would be Negroponte's US$100.00 laptop. The device itself enters this world as the product of partnerships and boundary-spanning alliances, national and financial. The device exists. Partnerships with governments and NGOs can be developed

to use the device to "equip" the South with, as Dufour puts it, the "21st Century tools of knowledge production [and access] and requisite social, political, and institutional capacities" . Further: the device can be used in advance of infrastructure or other investments: the device does not assume existing networks or even a continuous supply of electricity. Since the production of the device requires scale, it is especially suited to solutions that require the cooperation of institutions—e.g. school systems.

But what makes the US$100.00 laptop useful in a school in e.g. Kigali would also make it useful to the Gwich'in of the Mackenzie Delta in the Canadian NW Territories, or Asian, non-primary-English speaking school children in Vancouver. In fact, it would be more useful, at least initially. The US$100.00 laptop is a *k*-phase artefact. It represents the accumulated capital of years of development, years of largely autochthonous development in the case of North America. So the cultural and linguistic barriers would be fewer and the available social support—family, friends, institutions, the marketplace—would be greater. The technical support would be greater too. (In many cases, even among the most disadvantaged Canadians, the device could be used right out of the box.) The device is, after all, an instrument designed to promote development cleverly disguised as an attractive-to-children consumer product. The problem: Canadian retailers would probably, and quite rightly, balk at being forced to compete with high quality subsidized products. Hence, domestic use of the device would probably have to be narrowly targeted and tightly controlled if the OLPC were to allow it at all.

In sum: the US$100.00 laptop would probably return a higher marginal rate on investment in underserved sectors of the developed world or more technically developed sectors of the South. But can the device reproduce the social organization that produced it in parts of the world where the basis for such organization, as yet, does not exist? This is the more obvious contradiction of the device. The less obvious contradiction specifies itself in Negroponte's theory of development. This theory reviews in almost narrative form the cultural experience of North America's Baby Boom generation, complete with all its contradictions. Hence in interview and testimony the device transitions from an instrument of empowerment, subversion, struggle, and liberation redolent of Paulo

Freire's *Pedagogy of the Oppressed*, to an instrument of trans-national capital redolent of Prime Minister Zenawi's plan for Ethiopia, an instrument that can produce new markets for IT services delivered by IT developers of the G8, or new, low-wage, lower-cost pooling-grounds of IT training and expertise available to IT developers of the G8.

2G and 3G wireless technologies, on the other hand, confront policy planners with different possibilities and different constraints. The most baffling constraint is the near invisibility of the medium. The US Under Secretary of Defense For Acquisition, Technology, and Logistics' *Report of the Defense Science Task Force on Strategic Communication*, an otherwise thorough document that recommends leveraging US domestic expertise in managing intensely competitive political campaigns and intervening in news cycles to influence opinion formation, significantly does not mention wireless communications. The document comprehends older media in the form of television and newspapers, and new media in the form of internet communications. But the humble cell phone it omits to include in its analysis, this *despite* the Battle of Seattle or the US State Department's interest in the Lebanese Cedar Revolution.

2G and 3G wireless technologies may be especially useful with respect to Public Diplomacy (PD), which Daryl Copeland in his "Guerrilla Diplomacy: Delivering International Policy in a Digital World" describe as "the new diplomacy" that is displacing the old "Westphalian variety" of diplomacy . For Copeland this requires e.g. "the cultivation of opinion leaders, locally and globally, the strategic use of media, partnerships with business, the NGO community, scholars, and the like-minded" .

Whether PD is somehow post-Westphalian or not, existing and increasingly global cellular networks offer Canadian policy planners relatively low-cost opportunities to coordinate policy goals with opinion and attitude formation both at home or abroad. This is because Canada is linked to the developing world through its diaspora communities: Canada's local constituencies are increasingly global constituencies, and they often phone their former homes. Changing attitudes in West Africa, for example, may begin by changing attitudes in Toronto.

Cellular wireless is not, however, a broadcast medium—this would be another constraint. Message strategies would have to be formed that could exploit existing social networks and formations. But consider the predictive power of polls and survey's conducted using conventional telephones, and how that information can inform the highly targeted message operations of political operations. Could phone banks in Toronto be used to target opinion elites and community leaders on the ground in DR Congo or Kigali? The cellular networks exist—they are expanding in even the poorest regions of the world. But this possibility underscores yet another constraint: the urgent need for research into how people use what many regard as a trivial technology. Context or location awareness, access to core information networks like the internet or international telephone exchanges, increasing processing power—how can these developments help people live, work, find and network with one another, or pursue other goals? As Dufour concludes, "Canada has an opportunity to wisely use its leadership to work with emerging developing countries in the emerging frontiers of knowledge." Only in this case it is the developing world that can help Canada extend its own frontiers of knowledge—a revolution in communications is taking place in the developing world. What can Canada learn from it?

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