Moving Data
The iPhone and the Future of Media

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FROM THE CLICK wheel of the first iPods to the touch-sensitive screens of the iPads, Apple has redefined the way we communicate with our devices. As Steve Jobs, CEO of Apple, made clear in several interviews, the company’s approach to design was never simply about the look of the device; it was about how the devices worked. This concern with the “how” extends well beyond the domain of device affordances into the realm of “how” the devices are woven into the lifestyles of intended users and consumers. With the iPhone, Apple launched a product that is implicated within a matrix of cultural changes that concern not simply how we communicate but also how we live, play, affiliate, work, and learn in a digital age.

These changes—spread across domains—rest on a reconfigured relationship between bodies and devices. Where is the interface—that liminal place—between my phone and myself? Just as I know my hand to be a part of myself, so, too, I behold my iPhone. Where the Web made the multiplication of spaces a function of my ten-fingered hands—keyboarding and clicking—the iPhone requires only one or at most two fingers to move between spaces of the ear, the voice, the eye, and the mind. Like the iPod before it, the iPhone has become an icon of the smart device that presents the user not simply with a GUI (graphical user interface) but more tellingly with a NUI (natural user interface) that privileges touch, gesture, and voice recognition. I incorporate
it as a prosthetic extension of my corporeal being. Not merely an extension of my ear, as McLuhan would have argued, it is me. My body/myself—my iPhone/myself. I become the cyborg I always wanted to be.

Me and My iPhone

I grew up in an age of designer phones available in different colors to complement the décor of every room. Thus, I was generationally prepared to welcome the iPhone as a prosthetic device that would subtly but surely reconfigure my corporeal sense networks. Tumors might form, we hear, from the low level microwaves used to send and receive signals. Nonetheless, I keep my iPhone near me at all times, reluctantly letting go only in the presence of transportation security scanners or the shower. I am exceedingly anxious when it is out of my sight. I wear it more frequently than I wear my corrective eyeglasses. In many senses, the iPhone is the first ubiquitous wearable computational device. While it is true that all mobile phones could be considered prototypes of wearable computing, the iPhone, coupled with the wide-scale interest in the development of IOS apps, made it the platform of choice for wearable prototypes. As early as 2008, developers were exploring ways to attach the device to a set of glass frames to produce a rudimentary version of virtual reality goggles. In the time since, the use of eyeglass frames has been set aside in favor of the development of applications that allow an iPhone user to access augmented-reality experiences. We finally understand, perhaps, that we don’t need to “wear” the iPhone on the bridge of our noses for it to be wearable. We see with it in the palm of our hand.

My usage history maps my imagination and announces at every turn that I “was here” and “here” and “here.” My iPhone always knows where I am, even when I don’t. Even when no one can find me, the information I seek always does. These personal geographies mean that I am always potentially at home in the world. I can never be lost—even when my signal drops, my phone still functions as a homing beacon. Moreover, my iPhone use testifies to the productivity of consumption as the active appropriation of signs, symbols, and codes. In using it, I insert myself into the flow of media, images, voices, sounds, and data from which I activate an elaborate, media-rich communication network where all sorts of transactions take place that have as their common objective the compulsive reproduction of symbolic plentitude. My iPhone is a personalized read/write culture machine.
From that symbolic plentitude, I assemble a sense of self, aggregated from the bits and pieces I retrieve from various media flows. In so doing, I participate in what Manuel Castell describes as “mass self-communication”—the one-to-many communication modality that floods network traffic. But what I communicate is not a preassembled “self” but rather my self that is itself an assemblage of my travels through various networks. Like the Internet more broadly, the media flows I access with my iPhone are discontinuous narrative spaces. My assembled self provides a weak narrative framework for my travels through these virtual flows. But interestingly, as I leave traces of myself wherever I go in the form of passwords, purchases, downloads, texts, tweets, images, and end-user license agreements signed but not read, these traces are fed back to me in subsequent sessions in the form of personalized advertisements for what I once went looking for. My desires are mirrored back to me with uncanny precision. My self-in-formation is fixed by the way the network writes over me.

The entire purpose of the iPhone is, hence, to reflect me back to myself. As a looking glass onto my digitally distributed self, it mirrors to me my favorites, my friends, my landscapes, my adventures, my comforts, my hopes, my world that I have molded to perfectly suit me. As the key interface for my RAN (body area network), it ensures my preferred interaction style is always at hand. Its presence comforts me, not only because of the connection information it archives of my contacts but also because it has become my most intimate personal digital companion. It is more consistently present for me and with me than any human could ever be. It amuses me, informs me, reassures me, educates me, surprises me, hijacks me, soothes me, angers me, delights me, amplifies me, connects me, reflects me. As a device, it is the ideal techno-embodiment of the perfect mother.

This ideal has animated the imagination of science fiction writers for decades. One of the most evocative narratives to explore the promises and consequences of such a technology was conjured by Neal Stephenson in his novel, *The Diamond Age* (1995). In the year the novel was published, DVDs had just been invented, Google had just launched the beta version of its famous search site, and the first e-book readers were still three years from market. Manifesting the prescence that makes him one of the most fascinating twenty-first-century science fiction authors, Stephenson invents a technology called “The Young Lady’s Illustrated Primer,” which looks like a standard book but isn’t, of course. The Primer is a piece of advanced nanotechnology that uses interactive paper to create a book with special properties: through a
process of imprinting, the book bonds with its owner/reader to serve her as a lifelong, individually attuned learning portal.

‘As we discussed, it sees and hears everything in its vicinity,’ Hackworth said. ‘At the moment, it’s looking for a small female. As soon as a little girl picks it up and opens the front cover for the first time, it will imprint that child’s face and voice into its memory.

‘And thenceforth it will see all events and persons in relation to that girl, using her as a datum from which to chart a psychological terrain, as if she were. Maintenance of that terrain is one of the book’s primary processes. Whenever the child uses the book, then, it will perform a sort of dynamic mapping from the database onto her particular terrain.

‘The Illustrated Primer is an extremely general and powerful system capable of more extensive self-reconfiguration than most. Remember that a fundamental part of its job is to respond to its environment.’

As is typical for science-fictional devices, the wonders of the Primer are many. As envisioned by the main character, the Primer was created for use as an educational device for young boys and girls starting at the age of four. Indeed, for Nell, the beleaguered young girl character who receives a purloined Primer as a consequence of her brother’s petty theft, the book proves to be life transforming. She learns over time that the Primer will help her learn: “She did not know all the words, but she knew a lot of them, and when she got tired, the book would help her sound out the words or even read the whole story to her, or tell it to her with moving pictures just like a cine.” The fables narrated by the book change over time, providing Nell with important lessons about deception, self-defense, and justice.

We eventually discover that the Primer is actually a mixed-reality device that makes use of the services of anonymous “ractors”—people who work as paid actors who perform voiceovers and provide synchronous vocal instruction for digital applications. Miranda, the ractor for Nell’s Primer narrates life lessons pitched perfectly for Nell’s stage of development. What begins as a set of media-rich fairytales (revolving around Princess Nell and her magical companions) evolve into a set of dynamic virtual adventures (all narrated by Miranda) designed to teach Nell everything she needs to know to survive in her increasingly violent and hostile world. Over the course of the novel Miranda’s and Nell’s fates become intertwined as the Primer serves not only as a learning platform but also as an object of affiliation for the two characters.

‘The woman you seek is named Miranda,’ he said. All thoughts of crowns,
queens, and armies seemed to vanish from Nell’s mind, and she was just a young lady again, looking for what? Her mother? Her teacher? Her friend? And indeed, at the end of the novel, the characters meet for the first time when Nell saves Miranda’s life by designing a new nanotechnology that counteracts the devastation wrought by blood-based nanomotes that infect her.

As much as it is an entertaining work of science fiction, *The Diamond Age*, is an evocative fable about learning in a digital age. The Primer encompasses key features we yearn for in new learning devices: network access, configurable data delivery, customizable information aggregation, imaginative expansion capacity (that grows along with the user), and a recommender system to connect the user with other people (known or not) who have something to teach. If we squint, we see these specifications evident in our most sophisticated smartphones. For everything that it is—wearable computer, mirror of myself, techno-mother—the iPhone also signals the development of a new platform for learning in a digital age.

Learning designers and educational technologists are using smartphones and other mobile technologies in different ways. Some are building educational activities specifically designed to expand the range of phone users. For example, the Madrid-based company BabySkool creates iPhone and iPad applications to teach young children (infants to five-year-olds) basic language skills; in spring 2010 they released a new app called My First Words in Spanish. Such efforts to build programs for young children have led critics to ask if the development of mobile learning applications isn’t really a marketing ploy designed to grow the consumer base of the future. These critics notwithstanding, the promise that excites educators and designers is the use of smartphones as an ubiquitous interaction device that could transform the physical world into a space of annotated exhibits by enabling users to access information embedded in physical environments. Whether as mobile classroom or ubiquitous joystick, many educators are betting on the iPhone and other mobile devices to reawaken wonder in technologically jaded students by designing learning activities to open eyes and ears to the scenes all around us that have something to teach.

Learning on the Go

Not only does the iPhone allow access to digitally augmented spaces, but the multiplication of spaces *in my hand* is the iPhone’s magnum opus. This has a profound impact on the place of learning. Since the advent of the World
Wide Web, the physical place of school has given way to a proliferation of online educational places that represent entirely new spaces for learning. For many young people, school is no longer bound to a brick and mortar building; it is better understood as a distributed learning ecology. With the use of such smartphones, students traverse these learning spaces while they simultaneously traverse geographic spaces as well. No longer do they need physical access points; the infrastructure of learning on the go includes the digital connections among physical places, virtual environments, and mobile practices of access and interaction.

Michel de Certeau once made a poetic distinction between “space” and “place” when he stated that “a space is a practiced place.” A place has stable boundaries and a fixed location; a space is created in time through actions and practices. In this sense, school is a place, and learning is a spatial practice. This insight is not merely theoretical. It captures something important about the nature of learning in a digital age. Outfitted with their smartphones, as young people physically travel from home to school then on to after-school programs, they may have also virtually traveled through a dozen other learning sites: online virtual environments (such as Whyville), social networking sites (Facebook), and cultural portals (Youth2Youth). For all their differences in actual access to technology and tools, the spaces of learning have multiplied for this generational cohort, and the movement among them has become seamless, a matter of clicks rather than the transport of bodies by school buses.

Memes are cultural concepts that circulate through media of communication: verbally (through language), physically (through bodily habits and fashion), and technologically (through symbols and codes). As a meme machine, the iPhone enables the wide circulation and rapid dissemination of cultural genetic material. Members of the born-digital generation understand themselves as just-in-time learners, confident that when they need to know something they’ll know where to find it. These young people understand how to mine their networks, both digital and social, for their information needs. Many of them treat their affiliation networks as informal Delphi groups (a structured communication technique relying on a panel of experts.) The statistical phenomenon of Delphi groups demonstrates that even when each person does not know a factual piece of information, the aggregate mapping of responses from group members tends to cluster around the correct answer. For these youth, the process of thinking now routinely—and in some cases, exclusively—relies on social-network navigation. As they navigate intersecting digital networks, they are exposed to different learning communities:
those of peers, popular pundits, parents, media shills, and formal educators. Each community offers different data sets: opinions, recommendations, enticements, and requirements. In short, data mining from different information sources and media flows has become a crucial component of learning in a digital age.

But memes are not memories, and culture is not the simple accumulation of data, tweets, or links. Data do not equate to knowledge, and knowledge does not equate to insight. What is required to transform data mining into insight is the creation of learning activities that structure pattern recognition. The ability to apprehend patterns among data and to construct narratives that provide context for the meaning of memes results in the creation of knowledge and insight. Exploring this concern has resulted in the development of location-based learning applications that use the iPhone’s connection to the global positioning system to provide the context for a specific activity. While museums have been at the forefront of the use of location-based applications for the purposes of informal learning, the idea of using smartphones as an interface for context-specific learning activities has generated considerable enthusiasm among educators. The idea is to explore the concept of “situated learning” by bringing learning activities to students as they venture forth from classroom into broader environments. While the enthusiasm is high, as of late 2010 there are few examples of situated learning applications to review. But things are moving swiftly. For example, in October 2010, the GLS Mobile Learning Team (at the University of Wisconsin–Madison) released the Augmented Reality and Interactive Storytelling application for the iPhone. ARIS is an open-source tool that enables learning designers “to create location-based educational games, stories, tours and data collection activities for place based learning curriculum and mobile citizen science projects.” One of the activities created with ARIS, called Dow Day, allows middle-school students to view “situated” video footage of Vietnam War protests that took place on the University of Wisconsin campus. As they walk through the current campus landscape they can see the historical footage overlaid onto the view of the current scene. With tools such as ARIS now available, the situation is ripe for the development of a rich array of situated-learning activities.

Building Learning

Benjamin Bratton has argued that the iPhone is unique not because it is the best or the first mobile communication device but because it is “the first to
put it all together in a way that changes how a critical mass of consumers could envision a new genre of computing: interaction in the wild.” The wild, in Bratton’s view is the digital city, which is best understood as “a shared nervous system” whose membranes have been breeched by the proliferation of digital information networks.

The foremost infrastructural projects of our generation have been the planetary proliferation of digital information networks, and now another moves that infrastructure from an embedded sous-terrestrial network to a pervasive in-hand circuit of body and information cloud. Computation evolves from a rare, expensive national asset to a cheap ubiquitous vapor. That stream’s orifice is the handheld phone, PDA, homing beacon, Geiger counter, magic antenna, virtual goggles, scanning X-ray filter, field recording microphone, and camera that makes hidden wisdom appear; the device becomes a window onto the hidden layers of data held in or about the user’s immediate environment.14

As Bratton goes on to elaborate, the iPhone—as the trendiest version of the phone as “orifice”—made interaction with locative media an everyday reality for city dwellers. While his concern is the implication of this technocultural development for architects and urban environment designers, others are exploring a wider range of applications that imagine new sorts of interactions between residents and buildings equipped with dense, computational sensor nets. In these experiments, it is not simply that the user or student learns from a computationally rich “situated” place but that the place itself learns as well. These learning activities make use of the mobile devices to collaborate on the creation of knowledge not simply with other users/students (who may be physically present or not) but also with elements in the built environment.

Applications such as Google Maps, Flickr’s geotagged images, and even Twitter are part of the mobile ecology that enable co-creation and the sharing of knowledge among people who are distant from one another in both time and place. Users enjoy instant access to a vast accumulation of data and distributed intelligence regardless of their time or their place. To date, museums have been among the first cultural institutions to actively engage in the use and development of new tools and platforms that make use of mobile devices for educational purposes. For example, our recent research on “the distributed museum” itemizes the innovative ways that public museums and libraries in the United States have embraced mobile media practices.15 These institutions are using technologies of mobility not only to connect to new audiences (the “born-digital” generation, for example) but also to extend the
time and place of the museum itself. These mobile experiences have moved beyond the use of the traditional handheld audio guide to feature cell phone tours that include not simply audio but also image-based annotations. For example, the Walker Art Center in Minneapolis, Minnesota, offers a program titled Art on Call. When visitors dial a central number, they hear multiple voices offering interpretations of the artwork on display. Not only does the curator have a say, but so do visitors who can leave audio comments. Because the Walker Art Center also sponsors several public art installations and events throughout the city of Minneapolis, the Art on Call program also enables art visitors to connect to the museum from remote locations. In this way, the reach of the museum is extended beyond its brick and mortar buildings into the spaces of the city itself.

The use of mobile media for informal education offers important insights for the use of such devices for formal education as well. At the very least, these programs and experiences suggest the rich possibilities of actively engaging the user/visitor/learner in the creation of content not simply for the purposes of demonstrating "learning" (for the teacher or instructor) but also, and more interestingly, for the benefit of other learners. But perhaps one of the more intriguing vectors to explore based on these experiments in the use of mobile media for informal learning is the idea of learning on the go. Here we are encouraged to think creatively about how learning happens in and through the engagement with distributed networks of mobile computational devices.

If the original tag line for the iPod promised "a thousand songs, in your pocket," a kinship tagline for the iPhone might suggest "a million stories, in your hand." This sentiment is evident in a project by the Mobile Environmental and Media Lab at the University of Southern California called the Million-Story Building. Led by Scott Fisher, MEML explores the development of location-specific spatial storytelling. The Million Story Building project uses the iPhone to interact with a campus building to experiment with the notion of "ambient storytelling." Through the use of the iPhone application, building visitors and residents are immersed in "an emergent, responsive environment of collaborative storytelling." The experience is designed to encourage building inhabitants to develop a relationship with the built space. The building used in the project houses the USC School of Cinematic Arts; on its walls are dozens of posters from films that have involved USC students. The MEML research team created an activity called Movie Tagger that invites users to tag movie clips. Next to each film poster is a QR (quick response) code. When a user scans the QRC, the Movie Tagger application not only
provides information about the film (and the alum’s role in its production) but also engages the user by asking her to tag a clip from the film (displayed on a nearby screen). If the user agrees, Movie Tagger guides the user to the screen and prompts further input.

Additionally, as inhabitants begin to interact with the building and provide the requested information, a digital archive of all the collected videos, images, tagged movie clips, and other data is created. The resulting database will be useful to the School of Cinematic Arts not only as a way of developing a living history of the new building but also as a tool to harvest the collective expertise of the building’s inhabitants for the purposes of enhanced pedagogy. For example, as more movie clips are collaboratively tagged, professors and students will be able to access the database simply by using keywords to retrieve film clips: every classroom becomes an on-demand film library and archive.  

This project takes advantage of the sensor nets embedded in the building and the unique character of the learning environment: as home to the School of Cinematic Arts, the building is occupied by many knowledgeable film students and professors. The result is an enduring relationship between inhabitants and objects in the built environment, where each encounter contributes to the evolution of an unfolding story of learning and collaborative knowledge making. This discipline- and building-specific approach to crowdsourcing makes it a practice of everyday life lived within a media-rich and responsive architectural environment. As an example of interactive architecture, the project suggests that learning on the go is not simply about information acquisition but, more importantly, about contributing to the stories that make the built world meaningful.

The Million Story Building project is only one of several early experiments in creating new learning experiences using the affordances of emergent networks of mobile media. Interest in this topic is exploding in the United States. A new (2011) open-scholarship project called Learning Through Digital Media: Essays on Technology and Pedagogy, edited by Trebor Scholz, offers a online collection of essays that considers the learning opportunities of a wide range of new media, ranging from blogging applications such as Wordpress to the use of Second Life, Tumblr, and YouTube.  

This project enacts its own mission—readers are invited to comment on drafts of each of the essays. The results of these online asynchronous conversations will be disseminated under a Creative Commons license as a printed book and free download for various e-readers. Taken together, the essays perform a collaborative assessment of the learning affordances of new digital media.
While the iPhone is not the privileged object of these analyses, it certainly maintains a central position within the learning ecology created through the use of new digital media.

Living the Singularity

Just as the iPhone has emerged as the first ubiquitous wearable computer, Twitter might be reasonably anointed as its most stylish accessory. Communication in the twenty-first century is seamless, informal, and immediate; microblogging is the genre of choice. Life now is a series of 140-character Twitter moments. A minor earthquake in northern California may go unnoticed physically but not socially. David Talbot reported that after a January 7, 2010, earthquake, the Twitter website recorded “quake related tidbits coursing through the company’s servers at the rate of 296 per minute.”

In the first seconds and minutes after the quake, anyone tapping ‘earthquake Mountain View’ (or the name of any other nearby municipality) into Google’s search field found that the only hits pertaining to the new quake were . . . tweets. While the Google results page included direct information feeds from the U.S. Geological Survey and a slick Google Maps display of recent tremors [sic], none reflected the latest event. Official USCG-confirmed data on the quake wouldn’t shop [sic] up until 10:20 am [ten minutes after the quake]. But at 10:12 am, the sixth-highest search return was a rolling scroll of tweets posted ‘seconds ago’: ‘Wow, that was an earthquake jolt in Mountain View!’

Taken together, the iPhone and Twitter are the killer apps of the “singularity.” The term “singularity” was popularized by science fiction author Vernor Vinge to describe a time when the pace of technological change outstrips not only our human capacity to apprehend the transformation but also to do anything about it. Theorists react in different ways to the notion and its implications in a networked society. Pessimists fear the day the machines and the networks they form turn against us; optimists focus on the development of the network as a superhuman form of intelligence. Common to all visions of the singularity is the belief that human intelligence is undergoing a profound transformation as our interactions with networked cybernetic systems get more complex and extensive. The most hopeful version asserts that the consequence of networked human-machine encounters will result in
the explosion and expansion of human intelligence. Intelligent amplification, rather than artificial intelligence, is the promise of the singularity.

This vision is well represented among those who see the iPhone as the technological (and stylish) extension of the human body. Few (if any) commentators lament the unplugged "natural" body. The iPhone-augmented body has been thoroughly naturalized; it frames the vision of how things will and should unfold in the future. Five years ago, campaigns to develop computer-based education were met with severe criticism based on the uneven distribution of computer access. These criticisms have all but disappeared in the discussions about the future of mobile learning applications. With more than 5 billion mobile-phone subscribers on the planet, including two billion who live in developing countries, the issue of access doesn't hold the same rhetorical sway it once did. The meaning of the term "digital divide" must be reconsidered. Given the ubiquity of mobile-phone use and the increasing interest in the development of educational applications and platforms the diagnosis of the structure of (persistent) disempowerment cannot be based solely on a reading of the availability (or not) of technology. While this issue is beyond the scope of this essay, suffice it to say that the cultural and political implications of technological access across the globe have changed significantly with the proliferation of mobile media. This is not to say that the use of mobile devices is without a downside: all technologies have multiple and contradictory consequences. The challenge is how to imagine the range of these consequences while gripped by enthusiasm for augmenting positive intentions and safeguarding others.

When considering the use of iPhones and other mobile devices as platforms for learning, I wonder about the logics of mobility that they foment. As these devices enable network connections on the go, they promote a belief in unrestricted movement through space and time. But in light of the tightening of national borders and the increasing surveillance of people in the name of national security, the mobility offered by these devices is more a characteristic of the information conveyed than of the people who use the technologies. And this is what I worry about: that these devices will lure users into believing that mobility is more available than it really is. This is what cultural critics might refer to as the ideological work of mobile technologies. By providing an illusion of mobility, experienced as a user travels virtually from site to site and portal to portal, these devices draw attention away from the conditions and exercise of power through which the physical movements of users in time and space are increasingly managed and curtailed. For all that is promised by the advocates of these devices to make the world come alive as a media-rich learning environment, they are also the means whereby individu-
als can be tracked and tethered to a particular time and place. I raise this issue at the end of this essay not to cast a pall over the promise of our new mobile devices but to signal the ongoing paradox of our technological fascinations. We love our devices; they comfort us, provide pleasure, structure our hopes and aspirations. But at the same time, they are implicated in the ongoing consolidation of power, the institutionalization of governmentality, and the reproduction of inequality. The challenge for educators, tool/platform developers, and cultural critics is how to think complexity about the multiple and contradictory meanings and possibilities of these objects of desire. They are both/and. Even as I crave them as desirable consumer commodities—with all that that implies ideologically—I also want them to serve the greater social good: to augment learning, to enable access to collective intelligence, to sustain humane social networks. This is a lot to ask of a simple device. But as I suggested in the beginning, this device is not all that simple. It is a part of me and an extension of me. So in the end, what it accomplishes and what it fails to do will be a matter of my will, my agency, and my creative performances. This is what it means to be a cyborg in the twenty-first century.

Notes

1. I am not alone in this anxiety. Jan Chipchase, the former chief of usability research at Nokia, now at Frog Design, described the emotional bonds that people form with their mobile phones in his TED talk in March 2007. To ease such separation anxiety, a company called Zomm makes the “Zomm Monitor”—a type of digital leash that registers the signal strength of a Bluetooth connection with the phone and alerts users when they get too far away from it.


4. While much of the research on the creation of body area networks (BANs) focuses on the application of wireless sensor networks to monitor health and real-time body functioning, designers and engineers are exploring the use of BANs as the infrastructure for wearable computing. For a discussion, see Clive van Heerden, Jack Mana, and David Eves, “Wearable Electronics,” in New Nomads: An Exploration of Wearable Electronics by Philips, ed. Stefano Marzano et al. (Rotterdam: oro Publishers, 2001), 36–56.


6. There are two main product lines: the My First Words collection offers activities to enable children to learn important words in several languages. For further information see http://www.babyskool.eu/en/iphone.html (15 February 2011).
11. The Tate Museums in Britain have prototyped several mobile informal learning activities.
13. The GLS Mobile Learning Team has prototyped several augmented-reality learning games using ARIS, including one called STEEL that locates virtual “mines” throughout downtown Madison, which are accessed by reading QR codes. Students learn about mining minerals as they collect metals by downloading information about the mines they discover: http://arisgames.org (15 February 2011).