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Engaging the Public through Mass-Scale Multimedia Networks

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We're on the fringe of a world where smart, ubiquitous devices will interact intelligently with our day-to-day activities to provide substantial improvements to our lifestyles. The social implications of these technologies in providing us with an ability to form communities—to learn, share, and work toward common goals—are even wider ranging and more profound. Though designed to support individual users, many applications have the potential to be driven by national campaigns on topics such as public health, the environment, and the economy.

These applications might achieve a level of participation and engagement on a scale never seen before. They would support millions of people and allow them to share and gather rich multimedia data about their local environments. Putting interactive technologies and the power to create communities in the hands of the public will raise awareness and encourage debate and democracy on broad national issues.

The public as producers

Information monopolies as we know them—mass media broadcast and publishing companies with big production budgets, connected to media distribution networks and holding complete control over content, production, and distribution—often crumble. We face an era where everyday people can create increasingly sophisticated multimedia content. Multimedia hardware costs are falling, and integrated multimedia devices such as mobile phones and PDAs are becoming embedded in day-to-day living. At the same time, online distribution networks make it increasingly simple to publish and distribute content to large, interested communities.

Weblogs are perhaps the original example of our improved capacity to share and produce content. They provide support for an individual to achieve feedback on ideas and multimedia content in ways not previously seen on the Internet. More recently, we have seen the growth of podcasting (otherwise known as audio blogging), whereby users create digital audio (MP3) files and advertise them for public consumption. Video blogs represent the next level of sophistication. As cameras become cheaper and increasingly ubiquitous through integration into phones and other mobile devices, their proliferation is inevitable.

Multimedia content distribution networks allow the creators of all these expressions—weblogs, podcasts, video blogs, video, pictures, and text—find a broader audience. Consider IndyMedia (http://indymedia.org), a grassroots journalism site that lets anyone contribute topical content. Similarly, the Open Media Network (http://www.omn.org) encapsulates publicly created content within podcasts, video blogs, movies, TV programs, music, and news and makes it freely available. Advances in mobile and ad hoc networks will extend these types of services further because they facilitate sharing, participation, and feedback on multimedia data from mobile devices.

Participation through personal contribution

As we move from being consumers to producers, we become more active participants in a community. By virtue of an ability to generate and contribute to an idea, we can achieve much greater engagement with a community's collec-

Editor's Note

The authors investigate the technological challenges and social implications of multimedia applications that will be driven by national campaigns. These applications offer the opportunity to achieve a level of public participation and engagement that's more massive than we as readers might initially imagine. —*Frank Nack*

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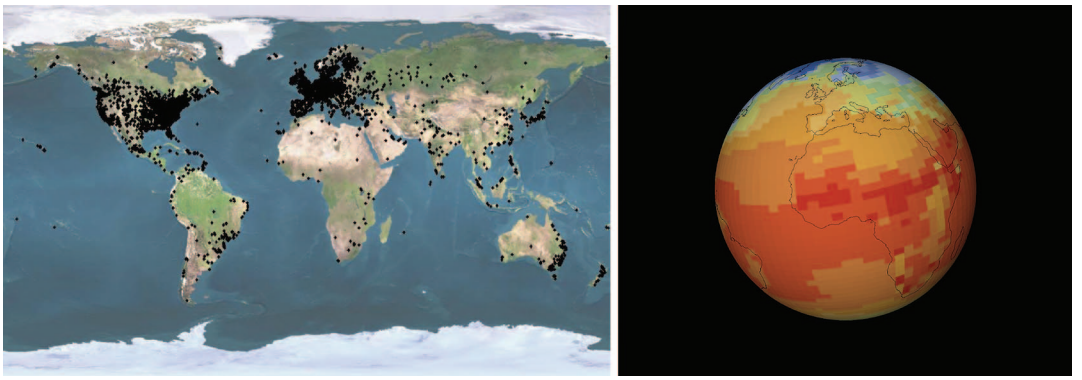

Figure 1. Map of all participants in climateprediction.net and a generated temperature visualization.

tive goals. The goals might be as straightforward as entertainment, but might also take on deeper social imperatives, such as a desire to learn, bring about change, and inform. The basis for community building predates computers, but emerging technologies and infrastructures give rise to exciting new ways of participation.

Perhaps the simplest example of mass participatory applications is the recent crop of reality TV shows, especially those that encourage mass-scale cell-phone text voting to affect an event's outcome. The overall architecture is fully centralized, the transmitted data is of low volume and complexity, and the end devices are mobile. Though the technology consists of simple SMS messaging, the payoff, in terms of votes cast, is high. The BBC's *Fame Academy* achieved more than eight million votes during its run. England's *Big Brother* achieved more than six million votes.

The gaming industry has achieved deeper quality participation in a mass-scale task that uses richer multimedia data. Nokia Game (http://www.nokiagame.com) was one early example that extended gaming to mobile devices. The game uses a range of media (such as TV, radio, SMS, newspapers, magazines, Internet, email, and telephone) to immerse users in a narrative-driven role play. During its initial six-month run, the game attracted 600,000 users from 28 countries. In more recent versions, it supports some ad hoc interaction with Bluetooth-enabled phones. Yet the main storage, management, and processing architecture is still centralized.

Social change on a planetary scale

The growth of mass participatory events can not only put an end to information monopolies, but might also steer news, entertainment, and outreach programs toward distributed information generation and storage. Consider "public resource" applications that make use of the public's collective resources to achieve a large and complex task, such as the BBC climate change experiment (http://climateprediction.net; see Figure 1) or the World Wildlife Fund ecological footprint project.

The BBC's climate change experiment[1] is one recent widely publicized example of many emerging public resource applications (such as EPSRC's Participate Project; http://www.epsrc.ac.uk/PublicEngagement/default.htm). The BBC's climate project aims to forecast the world's climate throughout the 21st century. Users download software that utilizes individual PCs' idle CPU cycles to process raw model data and return results to a distributed database. Experts then query the database to build the projected climate model. The data volumes are high: it's expected that during the course of the experiment, several PetaBytes of data will be produced, with each PC responsible for processing at least 500 Mbytes of data.

The project uses a rich array of multimedia data to stimulate and prolong a user's interest, including fully interactive virtual globes, multiple climate maps, and satellite views. Although the processing takes advantage of distributed computing, a centralized system controls client PCs' coordination.

The system doesn't support interaction between clients. However, participating users or teams can use message boards and take advantage of a credit system that creates a social hierarchy based upon processing levels achieved so far.

The project's topic and goals have secured a large-scale uptake. In four months, the climate change experiment has attracted just under 224,000 hosts and participants from 163 countries (http://bbc.cpdn.org/usermap.php).

The World Wildlife Fund (see http://www.wwf.org/) has also created a project that recognizes the currency in building communities through participation. The ecological footprint project (see http://www.myfootprint.org) attempts to encourage debate about individuals' impact

upon the environment. Participants upload and share multimedia data which the system uses to calculate the amount of land and sea individuals need for sustenance. The project extrapolates data to consider whether the planet could sustain life for everyone at the same resource levels. Individuals can see how many planets their current living patterns represent and perhaps adjust their habits to live more efficiently.

Technical advances in mobile ad hoc networks take advantage of mass participation opportunities as well. For example, vehicular ad hoc networks (Vanets) utilize chance interactions of vehicles to share data and to support applications such as collision systems, safety warnings, mobile entertainment, and traffic reports. They share, query, and process large volumes of streaming audio, video, and raw sensor multimedia data. Because these applications are completely distributed, can scale to thousands or millions of users, and will support high client mobility, they can help to embed multimedia content distribution deeper into the fabric of day-to-day living.

These applications demonstrate that the public has a tremendous appetite for engaging in large-scale projects in which individual contribution forms part of a larger goal. Creating and sharing content or providing resources engenders a feeling of participation, a fundamental element for achieving large-scale adoption of public resource applications. When projects are seeded in existing communities such as schools and universities, and when their goals support learning or encourage and stimulate debate, they achieve greater engagement.

Participate

For social reform to occur, individuals must alter their habits. This doesn't happen in isolation; first, a community must become engaged. We all hear messages about global warming and its potentially dire consequences, yet we are only likely to change if we're able to do so as part of a community. We must be able to see not only qualitative results from our individual actions, but how our actions fit into a larger integrated community.

Large-scale data gathering and comparison offers the possibility of novel exploration into how pervasive learning takes place. Learning can be enhanced by actively engaging people in real-world scenarios, enabling them to work in groups and gain frequent interaction and feedback. While existing mass-participation systems such as interactive TV broadcasts, the Internet, and mobile communications provide a useful background, the new shift currently being proposed (for example, by the Participate project) will result in learning that occurs between individual peers, through groups, and from communities to populations.

Environmental science provides challenges in maintaining individual motivation while drawing on the benefits afforded by large volumes of data through mass participation. In the Participate project, we tackle a number of environmental science challenges. In seeking public participation, especially from students, we are motivated by the following questions:

- Can mass-participation technologies allow students to enjoy a hands-on approach to learning science in schools while also giving them a more global perspective?
- Does the ability to compare self-generated data with that of public and scientific sources enhance such behavior?
- What are appropriate representations of this data for peer-to-peer learning, and how do these differ when considering broader data-merging concerns?
- What constitutes sufficient motivation for the various target participants, and how might we innovate integration with structures such as the national curriculum?

The Participate project targets some of these questions and aims to build a class of applications that combines the popularity of reality television programs with the socially rewarding outcomes of projects such as the BBC's climate change experiment and the WWF's ecological footprint. It considers the outcomes of supporting the richness of multimedia content, as seen in weblogs, video blogs, and podcasting, with deeper levels of participation, as seen in pervasive games. The project aims to make new discoveries in environmental science topics and builds a framework to reduce barriers to participation by supporting interactions as seen in mobile ad hoc networks such as Vanets.

Building upon mass-participation campaigns, we aim to create a three-level structure, as Figure 2 shows. First, participants upload data through personal devices to establish a general picture of quality-of-life factors across the country. Second, local schools, communities, and environmental

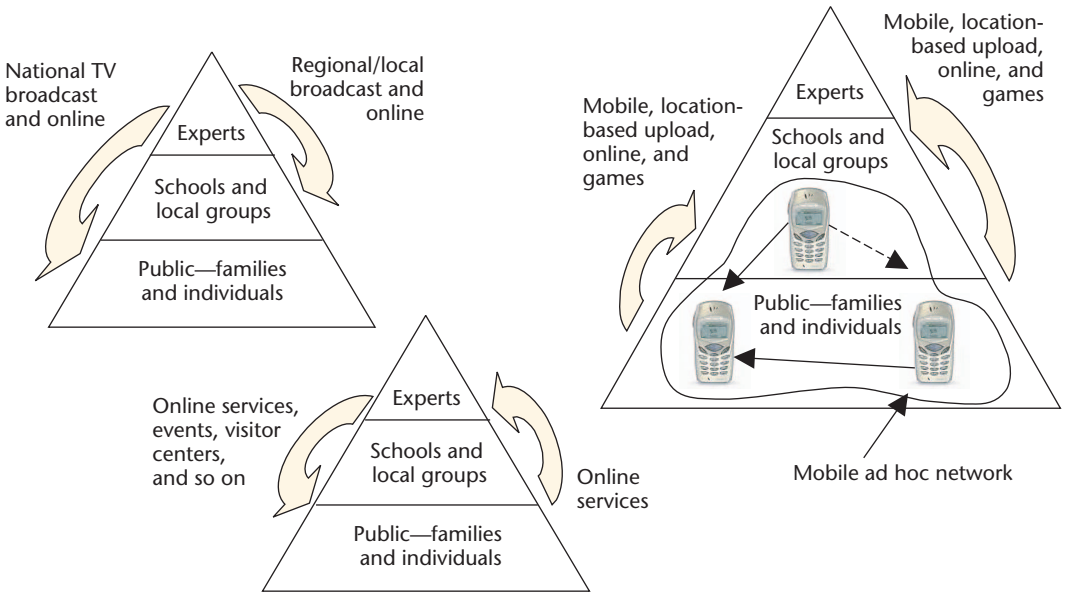

Figure 2. Mass-participation campaigns and their levels of public participation.

groups carry out focused investigations of particular localities, drilling down into the background data in more detail. Third, teams of environmental experts work with broadcasters to assimilate this information and carry out scientifically rigorous investigations at a few key locations. The experts then use online and broadcast media to provide feedback and direction that will drive the first two levels.

Participants use their cell phones to record observations or as sensors to perceive environmental phenomena such as temperature, noise, or pollution. Although the project is already content rich, we aim to reach mass scale and become more deeply established in communities, particularly schools. To achieve high levels of involvement, the project's themes were chosen to match England's national curriculum requirements. Participants are not only able to contribute resources to accomplish tasks—they're also able to provide and query data.

Challenges

Such mass-scale multimedia applications raise new demands for information distribution and storage as well as for sharing and querying rich multimedia data. With mobile, frequently disconnected ad hoc environments, the problem becomes more complex.

We as the multimedia research community must start to appreciate the demands of large-scale mobile multimedia networks and must develop and evaluate new data management techniques. Several approaches, including those emerging from the distributed database and grid communities, are now available.

Self-organizing peer-to-peer overlay mechanisms, which can provide flexible and scalable support for data storage and lookup, might prove useful in mass-participation campaigns as well. These novel peer-to-peer overlays might provide the basis for building applications on top of mobile, unstable, and unreliable environments. Distributed Hash Tables might be the key to scaling multidimensional querying of partially defined data, perhaps through range queries across distributed multimedia data.

The multimedia research community has the opportunity to support exciting, mass-scale, socially rewarding applications that encourage the participation of thousands or millions of people across the planet as they work toward the solution of socially significant problems. Despite the challenges, we as a community can once again offer technology that might become deeply embedded into everyday life. **MM**

Reference

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