Situating Knowledge on the Landscape: Expert and Citizen Science, Games, and Community

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Geologists and geological engineers, and the organizations they work for, are increasingly embedded in the digital fabric of everyday life. From the social graph to the embedded mobile experience, from text messaging to augmented reality, from work to casual games to competitive games to 'serious' games for education and training, citizens of the world live in connected and complex ways that meld the real and virtual, digital and 'real.' Geological surveys provide the backbone data to at least some of those experiences - at least some experiences are set in real space where the shape and nature of the Earth's surface matters - and citizens concerned with stewardship of the Earth at the local through global level may be keenly interested in the nature and use of that data. The changing nature of our tools, how we present geoscience data, and how citizens can and perhaps will be able to respond and contribute is central to the changing nature of geoscience in the public interest.

The line between what can be considered traditional software tools for geoscientists and what tools are not is increasingly blurred. As an example, we have numerous simulation tools that can consume high resolution digital surface models and produce vaguely realistic trajectory models for use in rockfall runout studies, helping us mitigate hazards along sensitive transportation corridors. On the other hand, gamers use realistic world models in 3d games with complex physics simulation tools built-in to blow up things for entertainment. Can these game engines simulate slopes? Can game-based simulations inform the public about hazards? Will the public have a better understanding if they experience a slope in-game versus as words on paper or video on screen?

Similarly, the line between what is a digital experience and what is a real world, 'natural' experience is increasingly blurred. We routinely examine geoscience data in order to make effective decisions, for example for new buried infrastructure in our communities. We can educate the community through outreach using that same data, and they may sometimes even listen. But we can also engage citizens in the process of making and critiquing scientific observations, discussing the implications of observed phenomena, and in choosing between options for future development. Citizen science, where members of the public can become informed about how and why to report on phenomena and then contribute valuable observational data, is widespread in observational biosciences but relatively rare in the geosciences. Simple tools can allow groups to form data-gathering communities that make observations about features, document them, and share those results. The same tools can build tours and allow authoring of simple games set in urban and rural spaces. We can even create stories authored on the ground and experienced by moving through the city.

Interfaces for digital tools, especially mobile ones, can be simple or complex. Urban mobile games can be as simple as a text with a question or as complex as an augmented reality interaction set in a specific place. Experiments blending different interfaces and forms of interaction where a group solves a puzzle set in a real space provide opportunities for students to learn about spatial phenomena that affect them. Those experiences are rooted in geoscience, urban, and bioscience data: augmented reality extends what can be seen beyond the immediate senses but requires a sense of place and connection that fosters understanding. Game engines and interfaces can also provide completely new ways to look at the geology around us: a tablet synchronized between the real world and a 3d model world can act as a magic lens that shows the geology beneath our feet, a

form of situated interaction that is compelling and can be useful even to expert users. We can move from a world where geosciences is 'on a map' to one where it is ‘right there.'

Finally, all these new ways to think about digital geoscience data, to use it, to share it, to create with it are based on some faith in the accuracy of that data, of what a point on a map means, what a unit is, and what we expect to find if we start digging. We may need to think of new ways to represent accuracy, to think about geological units, and especially to capture geological models as our ways to use those units and models multiply.