Surveying: Beyond mere existence

"In them at last the ultimate men arrive
Whose boast is not: 'We live' but 'we survive'..."
A.D. Hope

In a previous article I suggested that the reason surveying, as a profession, exists is to guarantee the connection between tokens based on spatial measurement, and the spatial reality that those tokens represent. This is a foundation from which to start consideration of surveying, rather than an end. We want to do more than just survive or exist; we want to live and grow!—**By N.W.J. Hazelton**

The ability to guarantee such a connection cannot stand alone. In an information environment (economy and/or society), we need to move with our information, rather than handing it off. We cannot be information generators alone, although that must be part of our role. We cannot be information managers alone, although that, too, must be part of our role. Likewise, we cannot be spatial information communicators alone, although that is a role we must include. We need to move with our spatial information around the information cycle.

The spatial information cycle can be pictured as in the diagram shown on p. 37. We take measurements of things in the real world, a traditional role for surveyors, and obtain measurement data. This may be an image, what's in the data recorder or field book, sketches or notes. This data is then transformed, selected, and structured into information, commonly a map or similar representation.

This first part of the cycle is well understood, and we've become very good at it. We keep getting new toys to do it better, faster, and cheaper: robotic total stations, digital cameras, GPS, laser scanners, digital levels. CAD, and various other software packages simplify the structuring and transformation work, and make drafting simpler. Databases and GIS allow us to turn numbers into maps and charts with ease.

The next important stage can be termed pattern recognition, for want of a better term. This is where we move beyond measurement. At this point, the algorithmic approach of transformations must be set aside for pattern recognition. This is where boundaries are determined and properties defined; where surfaces and objects are teased out of the point cloud; where photo interpretation makes sense out of pixels. This produces what we can term "knowledge."

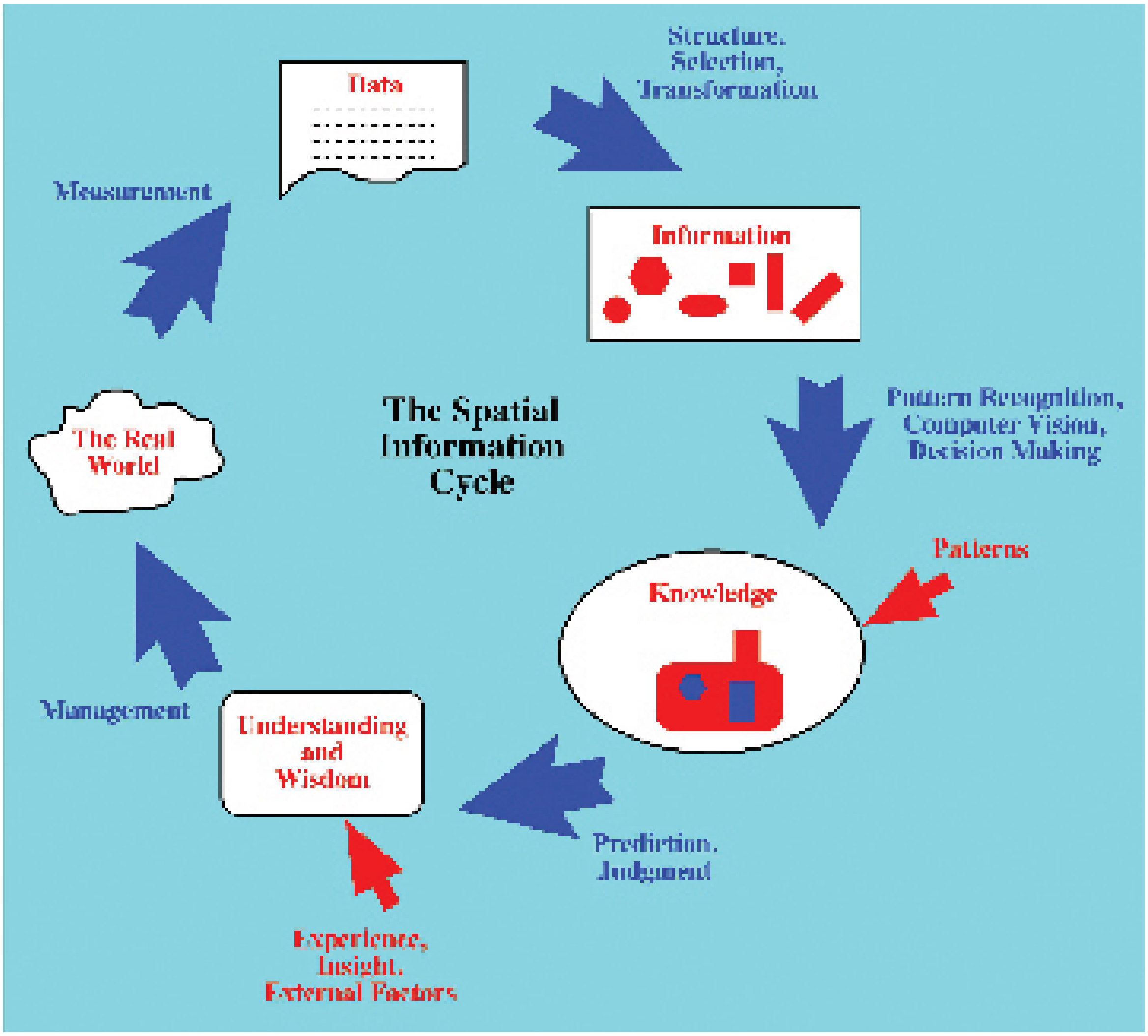
To differentiate between the terms here, "data" are facts, measurements and observations; "information" is data that have been selected, organized, structured, and transformed to meet some set of requirements. To this point, the process has been self-contained, apart from the requirements. As an example, a student in class may collect a lot of facts (data), but he or she would be wise to select, organize, structure, and transform those facts into something else (information) that can be used in the final exam, or in the workplace.

"Knowledge," by contrast, requires significant external inputs. In order to recognize patterns, the patterns must be known. To determine a boundary, a range of legal patterns must be known, and some of them will be contradictory, requiring decisions about which legal situation applies, and how it is to be applied. To find surfaces in a point cloud, software must be "trained" to "understand" what constitutes a surface, and then to recognize when a collection of surfaces may form a larger object. Photo interpretation can only be done if a store of patterns is available for comparison.

Within the larger discipline, pattern recognition is a major research field, as efforts are made to automate significant components of the map-making process, as well as scene understanding that will allow more autonomous robotic devices. While there is currently little, if any, research being done on automating the boundary determination process, it is not beyond the bounds of possibility that this could be done some day.

While pattern recognition is, to a large extent, a matter of finding and selecting a suitable pattern, the next stage in the information cycle requires experience and insight, which is something beyond pattern recognition. This requires predicting possible future scenarios, evaluating and comparing them, and making judgments based on experience, data, and "rules." These rules may be legal constraints, ethical guidelines, community standards, or movement towards an objective.

At this point, we may have what can be termed wisdom and understanding of a situation. From this point, we can manage the situation in the real world, and the information cycle is completed. Of course, the cycle continues indefinitely.



SILOS AND COMPARTMENTS

We spent a lot of time and effort segregating what we saw as our part of the spatial information cycle into neat little homogenous compartments. Then we spent a lot of time and effort erecting walls between these various sub-domains. These sub-domains were largely based on the particular way that we collected spatial information, usually based around specific technologies. So if we did it with satellite imagery, we were in the "remote sensing" sub-domain; if we used photography, we were in the "photogrammetry" sub-domain; if we used GPS, we were in the "geodesy" sub-domain; if we used a total station, we were in the "surveying" sub-domain; if we digitized maps, we were in the "GIS" sub-domain.

Each of these sub-domains has its own methods, transformations, and terminology. Each tends to produce different specialized information products. In many cases these are little more than different ways of saying the same thing. We have encouraged specialization at the expense of general understanding of the entire spatial information cycle.

There are several unfortunate consequences of segregating the profession into "silos." We have almost no graduate-level programs in this country which deal with general surveying issues: students must specialize, and we are finding it very difficult to recruit well qualified faculty to educate the next generation of professionals. The three U.S. surveying/geomatics academic groups that have split in the last few years are notable in that in each case, the division is largely between generalists (those with a surveying background) and specialists (those who came into the field without a surveying background). This is despite the reasons for the splits having almost nothing to do with this generalist/specialist difference.

The problem created by these divisions is that they make no sense in terms of the spatial information cycle, which is how spatial information actually works. The differences are largely concerned with measurement and data collection, a domain that is becoming much less important to us as it becomes ubiquitous and simplified. Fighting over the measurement part of the spatial information cycle is like trying to get a larger part of a rapidly shrinking pie: such "winners" as there may be "win" a shrinking domain and the enmity of the many "losers."

MOVING BEYOND MEASUREMENT

The old technology-based divisions are irrelevant when rethinking surveying in terms of the spatial information cycle. We need to think in terms of how we are moving our information through the cycle. How are we adapting and changing it to match the user's problems and needs? How are we incorporating the user's knowledge domain to enhance our spatial information, in other words, how are we adding value for the user?

We can argue over what to call it and how to divide it till the cows come home. But unless we act, and act decisively rather than divisively, it will be chickens, not cows, that come home to roost.

We can recognize several key areas for the immediate future. The first is measurement science, including 3-D and 4-D measurement, image interpretation and analysis, and sensor system. This will include most of the current sub-domains.

The second key area is spatial information infrastructure, which will include how we integrate spatial information and make it widely available. Google is already well ahead of us here, and as far as we know doesn't have many (if any) surveyors on its books. This area will also include county GIS and land registries.

The third area is communication of spatial information. This is more than cartography; it is how we as professionals integrate what we do into solutions to the clients' problems. It is how we bring non-spatial knowledge, experience, and expertise into the spatial information cycle.

Of particular importance in the third area: "…society needs all kinds of skills that are not just cognitive; they're emotional, they're affectional. You can't run the society on data and computer screens alone" (Toffler, 1998). If we want to be a profession, in an era that is anti-professional, we had better ensure we are on the right side of the society we hope will recognize us as professionals.

This list of key areas is not exhaustive and could be stated in other ways. But it is based on skills and knowledge that fit into the spatial information cycle and focuses on how we work with information through its entire life.

LEARNING, UNLEARNING AND RELEARNING

Since about 1950 surveying has been undergoing a revolution in technology, methods, and thinking. If we compare this revolution to the one surveying underwent in 1550–1650, we are about halfway through. In other words, there's a lot more to come. If we are trying to think in the ways we did in the 1950s, we are already half a revolution behind. The ideas and structures we have held and worked with for the past few decades are becoming increasingly irrelevant.

To move forward we need to unlearn some of our ideas. In this article, I have suggested that we need to unlearn our long-standing technological divisions within the larger profession, and re-think who we are and what we do using the paradigm of the spatial information cycle. "The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn" (Toffler and Toffler, 1999)

REFERENCES

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