

Challenging Research Problems in the Semantic Domain

GIM Int'l Interviews Professor Martien Molenaar, Chairman of the Scientific Committee for ISPRS 2000

By Jan H. Loedeman, Editor of GIM International

When we last month interviewed Professor Klaas Jan Beek, Congress Director and former ITC rector, he mentioned (off the record) the name of Martien Molenaar as a member of the hard core photogrammetric tribe at ITC, which had yet to be convinced that the future of the institute lay in RS and GIS. In 1983 Molenaar was appointed professor at Wageningen Agricultural University (WAU), where Beek had been educated got his education as a soil scientist. Molenaar restructured WAU's land surveying department by focusing research and education on geoinformation science within an agricultural and environmental context. In 1996 he returned to ITC to become professor in Geoinformatics and Spatial Data Acquisition.

With a wink to Beek, and paraphrasing Molenaar's own view on technological change, one might expect that it will be fifteen years before the breakthrough envisaged with the scientific programme for the coming XIXth ISPRS is implemented by the mapping professions. In this interview, Molenaar, chairman of the congress-scientific committee, as usual, doesn't mince his words; as usual.

One of your favourite opinions is the need for broadening the disciplinary scope of the mapping profession. What is the background to this opinion?

The number of photogrammetric professionals decreases inevitably, but mainly at the low-end level where purely operational skills are required. Knowledge of photogrammetric processes, however, continues to be needed for the interpretation and evaluation of results of current semi-automatically performed procedures. As far as research into traditional photogrammetric working processes is concerned there is very little left that still needs specific study. However, regarding image interpretation and image understanding, a lot of research still has to be done. Supervised semi-automatic building extraction, for instance, deals with crisp spatial objects. Though many technical problems still need to be solved in this process, these problems are relatively simple when compared to the ones encountered in identifying natural spatial features, like vegetation patterns, or in depicting specific tree species in a tropical rain forest. In this respect I see the need for a better integration of the geometric domain and the spectral domain, thus of what traditionally is designated as photogrammetry on the one hand and remote sensing on the other. Here a vast research field still lies fallow.

What is the need for a research programme aimed at automatic extraction of natural spatial features from images?

A major problem is that disciplines dealing with natural terrain features, such as botanists, foresters, ecologists and environmentalists, do not use uniquely defined spatial entities to describe the natural objects or features which constitute their

disciplinary subjects. But as soon as these disciplines start to use the digital tools now available for spatial analyses, I expect them also to review the way they define, structure and use their terrain features or spatial units of interest. So that the really challenging research problems have shifted from the technical domain to the semantic domain. Moreover, the recognition of singular objects is no longer sufficient to satisfy end user requirements. Many end users monitor and analyse dynamic spatial complexes consisting of many (spatially) related objects, changing with time. Data representing these has to be stored in well structured spatial databases to allow for various manipulations and analyses aimed at specific user groups.

Does this approach imply that the XIXth ISPRS congress programme is aimed also at professionals who unrelated to traditional applications of photogrammetry and remote sensing?

Although national mapping agencies and cadastres are still very important for ISPRS, there is at present an urgent need to attract people from a broader range of potential application fields. This view is reflected by the theme of the XIXth congress. We also hope to attract a significant number of computer scientists . Issues like Open GIS, federated databases, massive data flows and the complexity of 3D spatial data generates specific query problems, which need to be addressed by purposely- designed databases enabling specific spatial operations. We badly need help from experts in the field of large spatial databases and also of 'computational geometry', a branch in informatics focused on developing algorithms to find spatial relations between natural objects represented by spatial data stored in a digital database. I see a growing awareness of the operational advantages of this computational approach in several application fields, not only in cadastral and topographic mapping, but also in less traditional disciplines like vegetation science and physical planning, as well as in other environmental sciences. So if we as technologists claim that our techniques have progressed to a level at which we can hand them over to end users in various application fields, then we must be able to get these end users interested in participating in the ISPRS activities. But a gap of about fifteen years always yawns between a technical breakthrough achieved in a research environment and the implementation of that technique within an organisational working environment.

This last remark refers to an ever-returning issue, does it not?

Having a clever idea, which results in a purely technical solution, is only a first step. To master all the institutional knowledge needed to successfully accomplish the operationalisation of this solution is, however, a second and more difficult step to make. Commission VI is becoming aware that substantial research questions are identifiable in this area. Restructuring a mapping organisation so that it can implement new technologies efficiently is only part of the solution. As soon as such an organisation starts using new innovative technologies, its role within the existing geoinformation infrastructure will inevitably change. Nowadays, other organisations than traditional mapping agencies have access to digital geo-data sources and modern processing tools as well. So mapping organisations must cope with changing relations and interests. A real hindrance in this respect is that their products are bound to strict specifications with a long and strong tradition, inevitably resulting in long production times. As a consequence they are less flexible than many of their new competitors, who can provide marketable geoinformation products on a more up-to-date basis and at a lower price without the need to fulfil those tight specifications. During the ISPRS

2000 congress these emerging issues will not yet be so much at stake, but they will be explored in workshops. Our aim is to end up with some recommendations to the ISPRS and its commissions.

Issues related to the theme 'Geoinformation for All' lie at the heart of the ITC, as was stressed by Congress Director and former ITC rector Klaas Jan Beek in GIM's August issue. You work at ITC as well. So what is your opinion?

Especially for countries where existing sources of geoinformation, i.e. classic topographic map series, have become completely out of date due to a lack of adequate mapping facilities, high resolution digital satellite imagery presents an excellent opportunity to get their geoinformation databases rapidly updated. The use of new technologies, as discussed previously, is paramount in this respect, because investments in digital production facilities are fractional compared to the ones needed for classic photogrammetric mapping. During recent visits to developing countries I've been impressed by the investments that have made in modern equipment. The availability of appropriate tools does not necessarily form a bottleneck; the main point is to get them used appropriately and efficiently. National and local needs for geoinformation must be put in the forefront, irrespective of whether these needs refer to sustainable development, land upgrading, rain forest monitoring, urbanisation, or whatever it may be. The updating process has to be addressed from a point of view which reflects these geoinformation needs and not from a historical or traditional mapping viewpoint. So a big 'but' is the availability of qualified personnel to do the job. Without proper education and organisation the updating scenario outlined, is doomed to fail.

What you portray here goes far beyond the traditional tasks of national mapping agencies. So, ...?

Yes, in this respect other types of geoinformation will often have a higher priority while traditional topographic data play only a supporting role. It's no longer necessary to go through an entire topographic mapping cycle to get required information in an effective and reliable form. For some people this will sound like a curse in a church, but ... In many of today's applications, geo data is not required with the geometric accuracy norms in which geodesists and land surveyors so pride pride. It would be helpful for the deployment of modern fast and efficient mapping tools if the mapping profession could see that high accuracy is not anymore at the heart of most geoinformation. Hopefully they will be inclined to abandon the current production criteria, which date back to the beginning of this century, and start to approach the needs for geoinformation with more flexible tools. In this case, an enormous amount of work is already there, waiting to be accomplished by the mapping profession. If not, then ...

Does this view of yours imply that data quality must be considered within the appropriate context?

I remember very well my own experience when I started my job at the Agricultural University Wageningen. In discussions concerning accuracy I implicitly referred to crisp geometric accuracy, not immediately realising that my colleagues implicitly addressed with that same term also the unsharpness or fuzziness in thematic classifications which had an inevitable impact on the geometric extension of their

spatial entities. We both addressed spatial quality, but from totally different departure points. This personal experience clearly showed me that the concept of data quality must be considered in a much broader context than the one we as surveyors have come to grips with. The mapping profession must realise that geometric quality alone is not an appropriate criteria for most mapping-oriented disciplines.

This brings us back to the congress theme again and to the subject of professional education. What is your view on the role ITC can play in this respect?

Here at ITC, my colleague Dick Groot has organised several executive seminars aimed at top managers of national mapping agencies. At that level there is a distinct awareness of the type of problems I just mentioned. Requests directed at the ITC are often related to a redefinition of educational programmes. Hence, at the top management level of mapping agencies the proper insights are there but the experience to operationalise these insights within the entire organisation is as yet lacking, partially because management and professionals at the lower levels are focused on geometric accuracy still.

How do you think the necessary revolution in professional attitude can be achieved?

To get a proper view on the data types and data quality involved in a mapping process, input from the user environment is a must. The production process itself must definitely be streamlined to be efficient and cost effective, but the appropriateness and quality of the end product must become a prime concern. I like to stress that this problem is at stake in both the developing and the developed part of the world. Worldwide, however, I see an emergence of educational programmes for GIS and geoinformatics which focus on the assembly belt, i.e. on informatics, resulting in training programmes for operating main stream software packages, or designing data bases. Beyond doubt, these tools-oriented programmes are very useful, but when they ignore the content of the information being processed by those tools, they overshoot their target. Informatics and tools-oriented professionals will be primarily occupied by how they produce, not by what they produce. Then they will inevitably address user requirements, i.e. information needs, in terms of their own familiar production processes. Geoinformation, however, is primarily about messages, thus about content, and not primarily about the means or tools to broadcast and receive those messages.

A last question: what do you regard as indicators for a successful technical programme?

The feeling in the lobbies, where the unofficial meetings and discussions take place, will be a first indicator. As new trends need an incubation period, another good indicator will be the activities Commissions and Working Groups begin developments in the four-year inter congress period after ISPRS 2000. It will take four to eight years before we can really see if mainstream interests within ISPRS have changed in the direction I have advocated in this interview. For me, the key indicator will be a successful attraction of interest groups, other than the traditional ones, taking part in new developments. In this respect, the scientific programme of the XIXth congress will be one of the many steps taken in the development of the ISPRS.

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