

# Maps for Navigation

Comments based on discussion between **Scott Seeley** (Intergraph Corp., Huntsville AL, USA) and **David Douglas** (University College Gävle, Sweden)

presented by

David Douglas

Thanks for this opportunity to participate. The following comments arise; not only from our formal meeting a few moments ago, (if a meeting between two people can be called formal) but also from a conversation we two had that took place at the banquet table. After all, what is a banquet for?

Since the subject matter of this seminar is "On Demand Mapping and Cartographic Generalization" Scott and I wondered about that whole class of mapping where both topics are bound to be of supreme importance and interest. What could be more "on demand" than the presentation on a HUD (Hheads up display) in a fighter plane? How can nautical charts be generalized to suit the purpose better for certain classes of sea navigation? More on these topics later-- . Generalization and on-demand maps and charts for transportation is our concern.

The basic question arises from a perception we two had that the subject matter of this seminar was almost exclusively concerned with one type of map. Namely, it seems, that with very few exceptions where road maps were discussed, the topic being researched, parsed, and analyzed seemed to be entirely focused on topographic mapping of the type done in large government sponsored institutions.

We admired the progress being made, without a doubt. One could not suppress astonishment with the fantastic advances that have been made in automated digital generalization, both in the pragmatic vendor systems discussed, (such as those from ESRI, Intergraph, Laser-Scan, and within the host Institution itself) but also in the academic research papers where the demonstrations were absolutely dazzling. Specifically I would like to recall the memorable presentations of Peter Hojholt, Anne Ruas, and Kelvin Haire, where the animations positively gave the impression that we are changing the World, and that intelligence really can be programmed into computers.

I noted in my 1973 paper [David means his famous article on the 'Douglas' algorithms for line simplification; comment added by Rob Weibel] that line reduction would be but a small part of automated cartographic generalization. I believed then, as of course I do now, that the hard part would come when many such "small" techniques, such as simplification of more complex objects, and smoothing them, expansion, explosion, and displacement, would all have to be supervised regarding their impact on other features, and on other levels of features. The lists of tasks and tests would be huge and complex. The numbers of items affected by each and every

small change is potentially magnitudinous. The work on this is very obviously making exciting and excellent progress.

Concentration on the topographic map would seem to have both advantages and disadvantages. First, topographic maps are more complex, containing large numbers of features and a vast variety of different kinds of features. This has to make identifying elements and solving problems with them extremely difficult, perhaps interfering with discovery. But the scale changes through which topographic maps may be generalized may be more limited, and the results expected more predictable. The question is: will mechanisms developed for topographic mapping work with other types of maps and charts, or are the problems substantially different?

I needn't elaborate on the importance of maps and charts for transportation. The numbers produced are magnitudinous. I am sure you will understand that I have not had time to review literature or research tallies, etc. so I am presenting a few best guesses.

In his paper on Thursday, Sjef van der Steen presented the following estimates, which also may have been off-the-cuff, so I am not holding him to exact numbers either. He observed that there are approximately 150 members (cartographers) in these two ICA commissions, 1500 members of the ICA, and suggested that there may be up to 10,000 map-makers World-wide. Scott and I disagree. There are an extremely large number of maps and charts made for all sorts of transportation. Many of the practitioners have their own formal organizations, (such as the hydrographic charting societies and worldwide orienteering). Add to that endless streams of maps made for tourist consumption, of the free "tourist-office" variety, and, we think, there must be hundreds of thousands, or even millions, of map makers who are not, in any way, connected to, or represented by the ICA or any of its commissions. Yet their products are indisputably maps, and we choose to consider most of the authors to be cartographers.

There is something special about Aeronautical and Hydrographic Charts. Besides the need for constant updating, justifying the need for automated processes, there is a question of legal liability for accuracy. A shoal that was missed (generalized out) can sink a ship, and someone is responsible. This puts a whole new meaning on our field of research and is bound to have great impact on methodology.

Visual Flight Rules (VFR) Aeronautical Charts are often based on Topographic series maps, especially at the smaller scales of 1:250,000 and 1:500,000. Instrument Flight Rules (IFR) charts, landing, and approach charts, hardly have the look of maps at all, but closer examination reveals that they have all the qualities of any map, but the generalization techniques employed can only be described as fantastic: strictly controlled, as they are, by "purpose".

Obvious examples of generalization from the topographic-map-based VFR chart are the extra symbols for landmark characters, peculiar features exaggerated, e.g. spectacle lakes, racetracks, towers/castles/bridges etc. This is cartographic generalization *par excellence*, and certainly falls into the subject matter of these two commissions.

The sport of orienteering is notable for a number of reasons. First, we cannot ignore the huge numbers of excellent, highly detailed, large scale topographic maps of all types of landscapes that are made by practitioners, who very often begin by conducting their own aerial surveys --

showing just how much can be done outside of the auspices of government departments. Secondly, their maps are, by and large, excellent.

Thirdly, orienteering map makers seem to have completely rejected "standard" ideas of topographic colour and symbol on their maps. They also have gone their own way, generalizing them specifically for the function intended: to serve a competitive running race that combines with running, per se, the need for accurate and imaginative navigation. Orienteering mapmakers have much to teach us regarding generalization. That is because they do it well and they do it a lot, through a gambit of scales for different kinds of race; all the way from 1:3000 scale maps for beginners to 1:20,000 maps for advanced ski- orienteering, and they often generalize from scale to scale.

In the past week we had so much fun navigating in and about Barcelona, which is a new and exciting city for me, with one of these stick charts: the Barcelona Metro map. It is all worn out now from constant folding and unfolding, but it has been an extremely useful, almost essential, instrument to get around. Yet it seems to be a map entirely devoid of coordinate accuracy, replacing that with an essential and more important "topological" accuracy. I would have to call it cartographic generalization of an extreme sort.

In his introduction Thursday, Rob Weibel warned us of the profound impact of technology, noting that today almost all mapping is digital. He is absolutely correct, of course. But we must not think his comments apply only to topographic survey units in big government departments. All of the map makers I have mentioned above use digital technology. This applies to Aeronautical and hydrographic charting, orienteering, to the ubiquitous transportation and tourist maps. I regret not seeing more of the people involved in these walks of endeavor here at this conference, or at least as members of these commissions. They do belong here and they have much to offer.

That being said, the people who are here have made marvelous contributions. I wish to conclude by extending our appreciation to all of the presenters. We also appreciate the work of all those who have made this conference possible. Finally, we wish to express a personal note of gratitude for the ever-present, even-handed chairmanship, of the effervescent Rob Weibel and Sjef van der Steen, who made it all go so smoothly.