

## **Towards a new Photogrammetry?**

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### **Abstract**

Repeatedly we can hear comments about dramatic changes in *photogrammetry* as a result of the advent of remote sensing and digital image processing. This discussion paper presents a personal view of the author that concludes that the *technological* and *scientific basis* of photogrammetry is actively defined by computer science, and that it is the *application* only that provides for survival of the discipline within the mapping/surveying fields.

### **In Richtung auf eine neue Photogrammetrie?**

Wiederholt hören wir von dramatischen Veränderungen der *Photogrammetrie* infolge der Entwicklung von Fernerkundung und digitaler Bildverarbeitung. Das vorliegende Diskussionspapier stellt die persönliche Sicht des Autors dar, welche darin besteht, daß die *technologische* und *wissenschaftliche* Basis der Photogrammetrie aktiv durch Computer Science bestimmt wird und daß es nur die *Anwendung* ist, welche für das Überleben der Disziplin im Zusammenhang mit dem Vermessungswesen sorgt.

## 1. Introduction

The present evolution of photogrammetric technology touches upon all aspects of the field. It may well never have been more interesting to be a photogrammetrist, as metric photography now broadens into a wide array of sensors; as the positioning of sensors and ground points become feasible with the *Global Positioning System*; as the information extraction is no longer from film records but with pixel arrays; as the application moves from the creation of plans and map manuscripts to the creation and maintenance of computerized information systems.

There is broad, yet informal, consensus in the field that *everything moves* and that this movement already is rapid. It may come as a surprise to some, however, that developments are *accelerating* and that the transition from traditional photogrammetric *glass and metal* to a fully *pixel-based softcopy technology* is already operational and *revolutionary*.

Numerous distinguished opinion leaders of photogrammetry were exasperated from attempts to digest, and to recover from heated controversies about the recent growth from traditional photogrammetry to modern *remote sensing*. Yet, only a few years later, they find themselves now in need to cope with the pervasive advent of information systems, computer science and all the other changes of the field. Occasionally concern is expressed that photogrammetry may not even survive these changes as a distinct and identifiable discipline, and may merge into computer science.

At various international conferences, at meetings of the leadership councils of learned societies in surveying, mapping, geology, cartography and photogrammetry, one will currently hear voices who even propose a name change from photogrammetry and related fields to *iconometry*, *geoinformatics* or similar expressions. Numerous name changes in academic departments and governmental organizations are even preempting this trend and actually have adopted new names to add to or replace the word *photogrammetry*.

Name changes may not be important. However, the underlying changes of the field are. The following presents a perspective on the current trends in photogrammetry that has been expressed by the author at various conferences, often merely in oral form.

## 2. From Analytical to Softcopy Photogrammetry – A Revolution?

Figure 1 reminds us of the acceleration of change. While *analog* photogrammetry has endured from the inception of photogrammetry at the turn of this century to perhaps 1970, *analytical* photogrammetry is being made obsolete after only 20 years of accepted application.

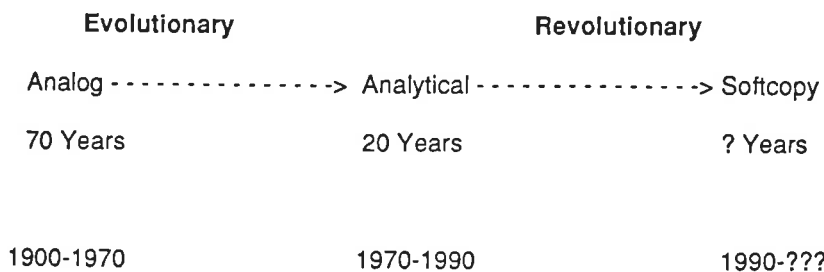


Fig. 1 From analog via analytical to softcopy photogrammetry

What follows analytical photogrammetry is, of course, the graphics computer workstation that is capable of processing vast quantities of digital pixels. In North America this is consistently denoted as *softcopy photogrammetry* to express a contrast with *film-based* technology, but also because in the much broader computer application, one denotes data and documents stored in a computer to be in a *softcopy format*, whereas printouts on paper or film are denoted as being in a *hardcopy format*. In Europe one seems to prefer the name *digital photogrammetry*.

Why is the transition to softcopy photogrammetry revolutionary? *First*, one will have to conclude that the old photogrammetric knowledge has become largely superfluous, to be

replaced by new knowledge in computer science, image processing, pattern recognition and sensing technologies.

*Secondly* of course, one finds that the applications are changing. Instead of patient paper manuscripts, one needs to deliver intelligent components of digital information systems. Instead of producing data over a period of years, they are to be produced instantly. Instead of developing a complete national map coverage, one needs to *monitor* ephemeral phenomena.

*Thirdly*, the access to photogrammetry changes. Previously the creator of data was a highly trained photogrammetric specialist, and the user of the data was far removed from photogrammetry. Automation and cost, however, as well as need, all cause a breakdown of this separation and end-users become involved in the creation of photogrammetric data. The Geographic Information System (GIS) may include the image as a native data layer, and stereo-viewing may become a commonplace feature on GIS graphics computer workstations. As a result we might find what one could call a *democratization* of photogrammetry.

### 3. A New Segment: GIS-Photogrammetry

We may define photogrammetry as a technology, or we may define it from its primary application. In fact, of course, it is the application that justifies the existence of the field. Traditionally this has been classical *topographic imaging* and so-called *non-topographic* or close-range photogrammetry. The rapid and all-encompassing transition of the mapping field towards the GIS now causes a third distinct application to emerge, the use of photogrammetric data and technology to create, use and update a GIS.

Characteristic elements of such GIS-photogrammetry consist of the creation of images as a native GIS data layer; the combined use of various GIS data formats in combination with images; digitization, storage, transfer and retrieval of GIS-imagery; updating of a GIS; automating GIS processes; visualization issues, etc.

### 4. Will and Should Photogrammetry Survive as a Separate Discipline?

One is often tempted to look at photogrammetry from a technology point-of-view. Figure 2 presents the functions of a typical photogrammetric softcopy workstation. It is evident that photogrammetry is reduced to a software package and a procedural manual. Technologically, therefore, photogrammetry will become simply a (small?) element of computer science and will cease to have the identity of a separate discipline.

However, we must very definitely look at photogrammetric survival from the point-of-view of the mapping application. We see *four pillars* of the mapping field: public surveying and mapping institutions; the equipment and systems industry; the service industry; academia. Each may provide for a different degree of robustness against change. The surveying and mapping institutions will, of course, continue to exist and be the *motor* of defining a need for, and of ensuring the continued existence of the field of photogrammetry. The equipment and systems industry is expected to change into the software and systems integration industry; photogrammetric equipment will be replaced by generic computer workstations *without* specific photogrammetric hardware. The service industry is experiencing a convulsive change that is driven by the GIS. A separate non-GIS service sector ceases to exist: to survive with photogrammetric service capabilities, any business needs to be driven by GIS-expertise and photogrammetric expertise merely becomes an appendix.

Finally, academic practitioners of photogrammetry must define a new scientific foundation for the field, now that separate equipment is vanishing and point positioning has been reduced to GPS measurements or the use of easily available triangulation software.

The academic segment of photogrammetry will have more responsibility than any other to ensure the survival and well-being of the field. There exists an abundance of opportunity in the

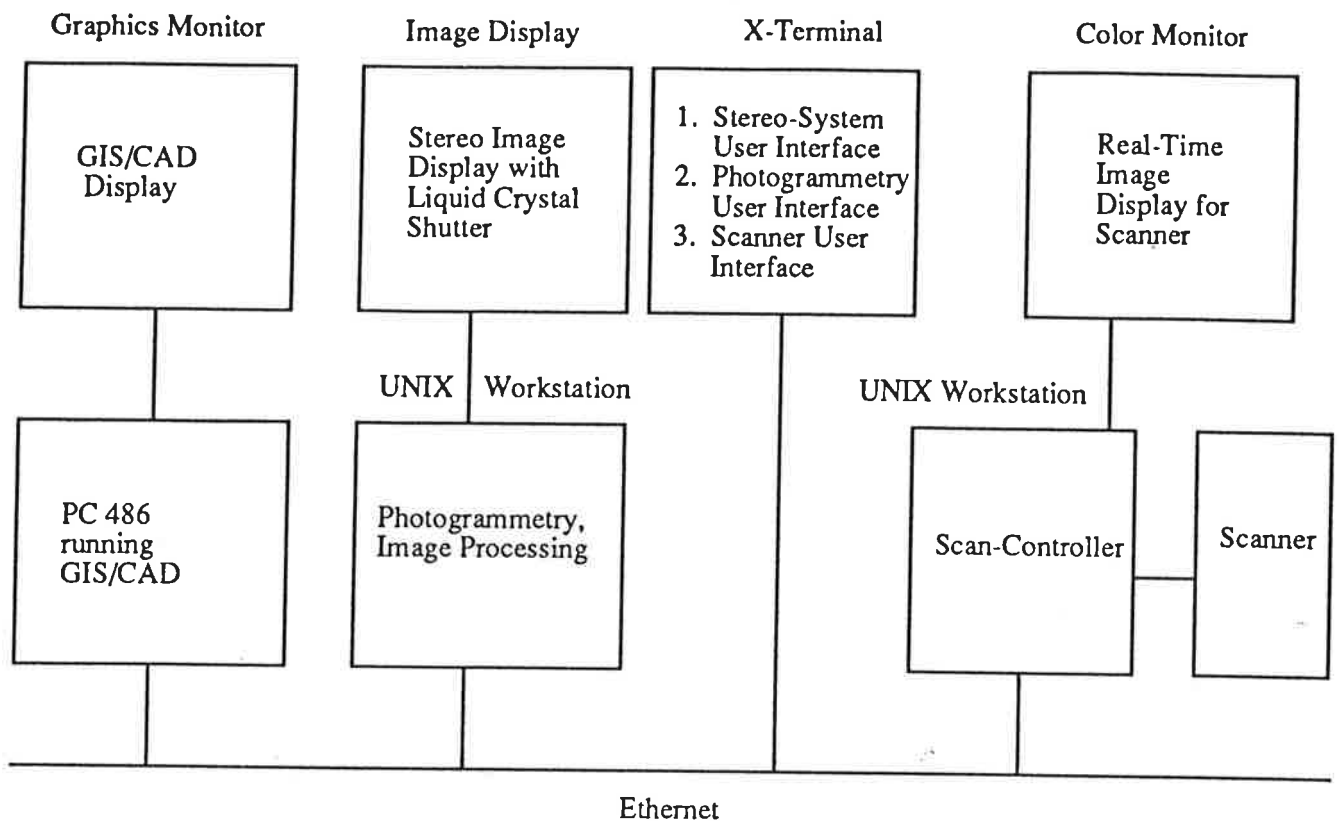


Fig. 2 Functional components of a typical softcopy photogrammetric workstation

context of adding *vision* to the computer and of integrating sensing technologies with the computer and with useful applications.

It certainly seems, therefore, that photogrammetric technology will continue to be needed, and that new technology will and must be developed. It may appear also, however, that the academic home for the field could as well or better be with computer science rather than mapping.

## 5. Conclusion

As many institutions of photogrammetry complete their transition into the era of remote sensing, they now face the pressures of coping with the GIS, electro-optical sensing and digital image processing. It is not surprising, therefore, that many experiment with name changes into *image processing*, *iconometry*, *geoinformatics*, *geomatics*, *iconic information*, *image information engineering* and the like. Instead of dwelling on names, this contribution attempts to provide a perspective about the contents of the photogrammetric discipline. It is argued that photogrammetry is subject to revolutionary changes, that its applications are significantly affected by the advent of the GIS, and that the field could well be submerged into the newer discipline of computer science.

It is felt important to differentiate between a discussion driven by applications of the field in mapping, and that driven by technology. Photogrammetry, while firmly rooted in mapping, has historically also found a home in non-mapping applications. The revolutionary transition from film to softcopy data may broaden the mapping base through the GIS and remote sensing, and may cause opportunities to grow in industrial and medical applications.

Photogrammetry will thus continue to exist and even find broader acceptance through democratization, under whatever name, and in whatever academic context.