Chapter 14

CAD in the Netherlands: integrated CAD

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One of the things in which a small country can excel is its number of architects' offices per inhabitant. In the Netherlands this is approximately one in 6500, or twice the UK density (CBS, 1984; CICA, 1982). Of the 2150 Dutch offices, 88 per cent employ less than 10 people, which compares rather well with the British Situation. Table 14.1 compares the UK statistics on computer penetration with the Dutch ones.

Table 14.1 Computer penetration in Dutch and UK architects' offices

	Number of architects' offices			Percentage with computers		
	< 10 persons	≥ 10 persons	Total	Total[a)]	Personal CAD[b)]	Other CAD
Netherlands	1950	200	2150	10	0.7	0.6
UK	4000	700	4700	35	5	2.5

[a)] including word processing.
[b)] AutoCAD, CADPlan, MacDraw.

Although the numbers in *Table 14.1* are based on a limited survey only, and are consequently rather unreliable, they do have an indicative value, and show that the Dutch quantitative back-log is largest in CAD.

Personal CAD started in the Netherlands only a short while ago, with the acceptance of IBM-PC and compatibles. By then many systems had been installed in the UK on computers such as the Apple II and BBCmicro. With a present annual growth in this area of computer use of 260 per cent, the Netherlands will be at the present UK level of penetration in 1987. A similar back-log can be noted for larger (mini- or supermicrocomputer-based) CAD systems, which are currently increasing in the Netherlands at a rate of 150 per cent per annum. At the same time, UK CAD penetration in architecture seems to be about 20 per cent of that in the USA (Doubilet, 1985).

For the Netherlands it is interesting that its boom in CAD, on average an annual doubling or tripling for the next few years, is likely to coincide with a revolution in CAD itself. There is no doubt that very soon the personal and larger CAD systems will clash at supermicro-level.

Figure 14.1 shows that, not counting offices with less than six personnel, over 50 per cent of offices in the Netherlands now have computers. However, to find any significant CAD penetration, including personal CAD, one can only refer to offices with over 30 personnel. Consequently the biggest next growth is to be expected in offices over over 20 personnel. These constitute only 3 per cent of the total number of offices, but take

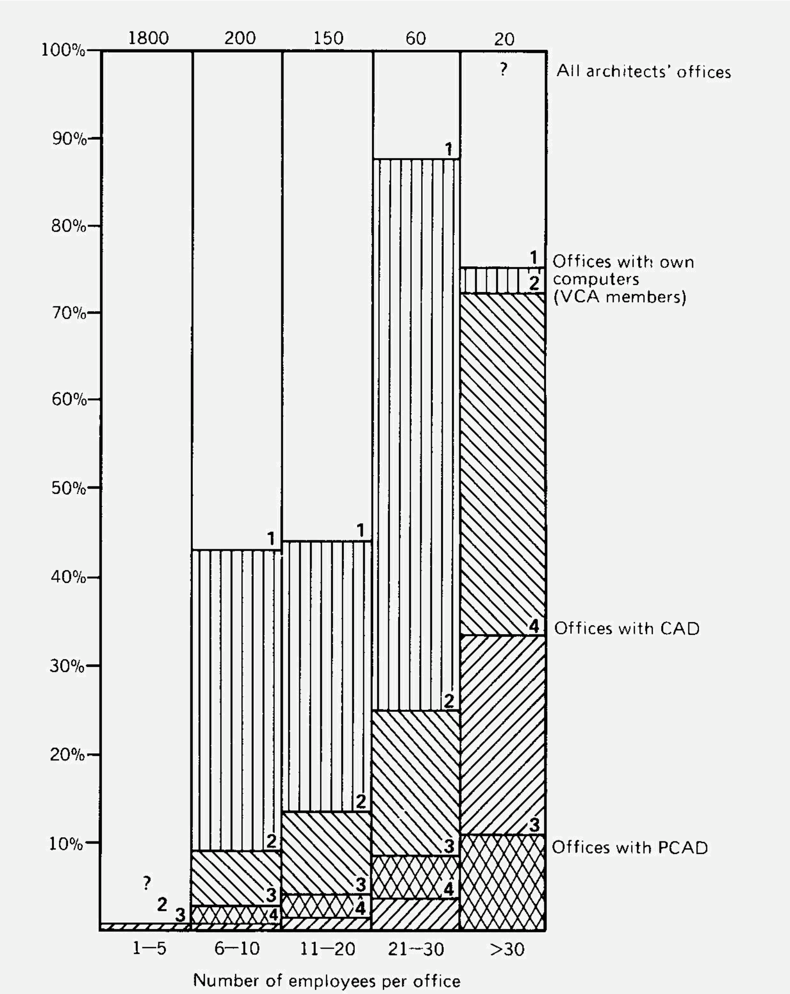

Figure 14.1. Percentage computer use and type by office size (for indicative use only)

approximately 25 per cent of the work, so although CAD has little impact now, this situation may soon change.

Figure 14.2 shows computer use by type of application, with designrelated tasks only in third place, and CAD (drafting) in sixth place. Personal CAD is so new that most users are still experimenting with it. As yet there is little experience in personal CAD as a tool for production. CAD (with a D for Design) is hardly practised at all. Only EGM in Dordrecht, making occasional use of GOAL, and KOKON in Rotterdam, with an Apple-LISA-based system for floorplan layout (a system for user participation, using a limited range of components on a restrictive grid), should be considered as carrying out design with a computer. Depending on one's definition of CAD, all the others use their computers for design documentation and/or design product appraisal that is not directly related to the process of design.

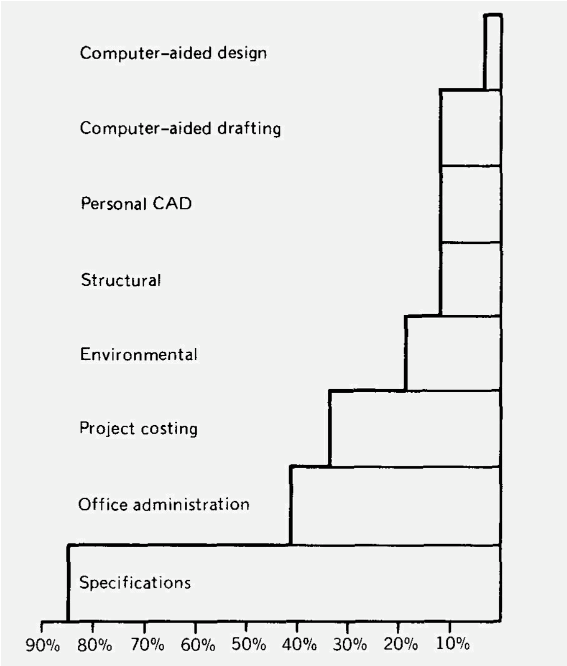

Figure 14.2. Computer penetration by application type (VCA members only)

Interestingly (but not surprisingly) the order of *Figure 14.2* coincides with the computerization paths that most offices seem to follow, which is shown in *Figure 14.3*.

This chapter addresses further the three I's of applied informatics: Incompetence, Integration and Innovation.

14.1 Incompetence

In the Netherlands, appreciation and use of computers lag far behind, perhaps as much as ten years, their contemporary hard- and software technology. Apparently it is much more difficult to usefully exploit new technology than to develop it. Thus to be found incompetent in this area is not necessarily a vice but a stimulus. Only a few users can boast full competence. Unfortunately some appear to be unaware of their incompetence, and some choose to remain incompetent.

One of the many places where incompetence becomes apparent is where government agencies have to take computer-related decisions. In the Netherlands we are blessed with a jungle of unstable possibilities for subsidies (many of which are open to multiple interpretation) to applicants as well to the bureaucrats themselves. A recent effort to provide more direction in public research by bringing together the views of over 30 experts in the field *(Werkplan . . ., 1985)* resulted largely in a set of incomplete generalities. It is hoped that these may function as a political

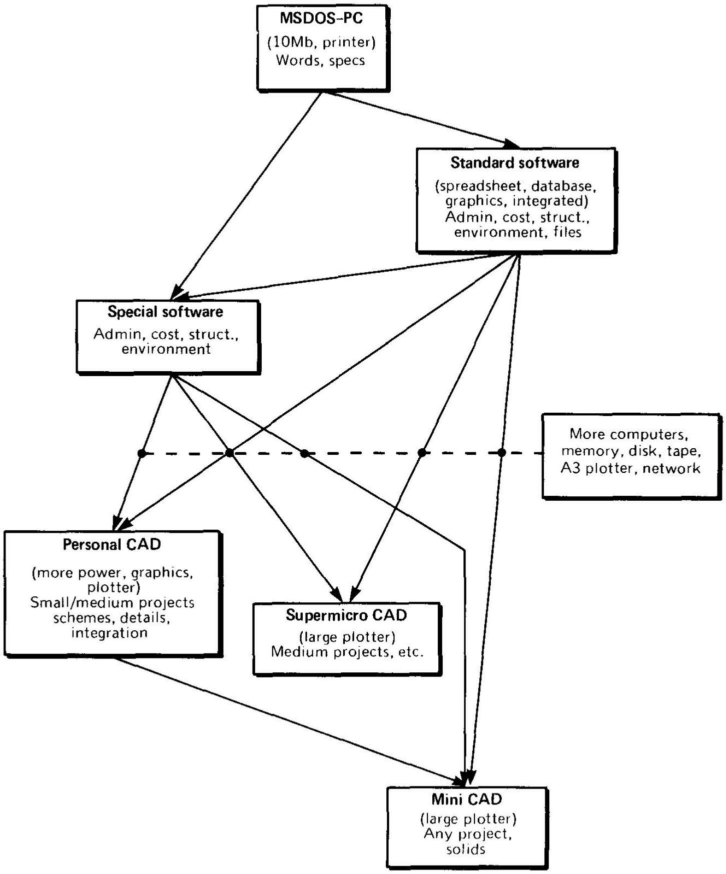

Figure 14.3. Computerization paths for most architects' offices

statement upon which smaller groups can formulate something more practical.

Some structure in research and development is much needed. If the government does not follow a structured approach, it subsidizes fragmentation. That this is actually happening can be concluded from surveys undertaken by the VCA (Society for Computer Use in Architects' offices), which indicate that the amount of building software presently being developed bears no relation to demand (van Houten, 1985). Too many small software bureaux produce too many similar applications for too few users. Many software developers also have the tendency not to develop in depth but in width, to embrace as many application areas (or markets) as possible. Consequently one can expect a proliferation of software houses, from two persons upwards, that offer 'total solutions' and 'integrated systems'. In the end only a limited number will survive, but meanwhile a vast reservoir of development potential will have gone to waste, and a fragmentation of users, each with their own 'total solution', will have resulted. In the Netherlands the collapse of BouwBIT, once a trend-setting software developer for building design, is an early example of this phenomenon: a small four-to-six person team developing a good concept, then finding itself too small to act in support of the resulting product and unable to develop new products as a necessary reaction to the next generation of technology.

It may take years to clean up the software pollution whose production we are now stimulating, and this could be largely prevented by an anti-fragmentation strategy in governmental subsidies.

Another area of incompetence is to be found in architects' offices. The problems of unbalanced hardware and software acquisition, ill-managed introduction strategies and over-optimistic expectations have been well publicized. Over the last two years the author had the privilege of working for the VCA, coordinating acquisition, introduction and use of computers at some of the approximately 100 architects' offices in the Netherlands. He found it a very hopeful sign that most of these offices realize their relative incompetence and carefully explore ways to overcome it, applying what might be called 'conservative innovation', and employing the most appropriate method: by doing. Consequently, the image of the stupid architect falling in every possible trap of computer introduction certainly does not apply to the present situation.

Also very encouraging was the fact that, hardly ever in those two years did architects make a secret of their progress and were generally willing to share experiences, programs and data, often at no cost. As in other disciplines some offices had to pay a high price for experience gained. Most, however, once they move into CAD, continue. Now that offices are increasingly using some form of CAD it is high time to assemble the experiences of the forerunners, otherwise a few hundred offices risk making the same mistakes all over again.

A final area of incompetence that we will mention is that of the CAD advisors. The standard practice for a CAD advisor is to assess the CAD potential of the client, draw up a computerization strategy, perform system selection tests and set up an induction programme. Such a procedure is very relevant for large organizations acquiring a large CAD system, but is not feasible for an organization of less than 25 people (98 per cent of all architects' offices in the Netherlands) and on a hard- and software expenditure of ƒ50 000- ƒ1OO 000. With the increasing popularization of CAD another type of advice is required. Since it does not seem viable to advise groups of offices collectively as the problems are seldom identical as well as synchronous, new advisors should be prepared to give off-the-shelf advice, backed-up by research. An organization such as the VCA will then find itself ideally placed to give additional global advice and to advise the advisors on keeping accurate records of what the architectural profession is actually using and how.

14.2 Integration

At the end of 1982 John Lansdown noted that an integrated system is not beyond the state of the art, but beyond the state of demand (Pipes, 1983). Now, if not for some time past, this situation has changed appreciably.

Globally there are two approaches to integration. The first has been adopted by some large CAD-users in the USA (USArmy CERL), Japan (NTT, Shimizu, ACT-Project) and the UK (Oxford RHA, Scottish SHA) (Schijf, 1984). They (partially) use or are developing systems containing a (set of) database(s) to which many applications in various design phases are connected for use by different design disciplines. Such systems were reported at the 1984 CIB W78 Symposium on Integrated CAD, and it may be expected more will be presented at the 1985 CIB Symposium. These developments, ongoing for the last 15 years or so at mainly academic research institutions, may be effective for very large organizations, provided all the expertise required for computing as well as for each integrated application is available. Also the organization should have consistent and stable information paths between design stages and between disciplines. Finally, they should have the capital for the considerable amount of hardware and development required.

A number of smaller-scale systems of this type (e.g. Acropolis, Gable) have been available for some time for medium-sized design organizations. So far they have failed to have an impact on computer use as a whole, mainly because the above-mentioned information paths do not exist, and because most of these organizations simply do not have sufficient work to make these systems profitable.

For medium-sized and smaller architects' offices (in the Netherlands approximately 70 per cent are smaller than five persons) such requirements can never be met. They need something much cheaper and more flexible, as well as the opportunity to use their hard-won experience, with separate programs for different tasks. Their persistent demand is to link their specification program (read: word processor) to their costing program, and on to their drawing system. Some would be even more happy if their energy programs could also obtain some of its input from the drawing system, and, of course, the drawing system should produce perspectives and work from sketches to working drawings.

An important stimulus toward this kind of integration is that all applications mentioned, including (in the near future) AutoCAD-like systems for drawing and perspectives, run on IBM-PC or similar machines. The bulk of computer use in architects' offices and the biggest growth is to be found at this level of computer applications, which can expect soon to be upgraded to IBM-AT or something similar. From a technical point of view little stands in the way for this integration of individual tools. Developments towards integration that do embrace these aspects may bring a breakthrough for integrated computer use in architecture. Hopefully, the Dutch 3RM-development project (see Chapter 7) will use the momentum for its own benefit and not result in another isolated effort.

The major obstacle for such an integration is the problem of data classification. As soon as more than a one to one data transfer is required then every parameter should be separately identifiable. A short study undertaken in Delft (Weener, 1985) suggests that all building project data should be classified in at least a six-dimensional matrix:

(1) What: level of material REG (material, prefabricated product, complete construction, S*f*B-element, building);
(2) When: phase of design/building process (from initiative to use);
(3) Which: data stability (fixed context: e.g. climate data; periodic context: e.g. unit cost; fixed project: e.g. programme of requirements; design data: e.g. choice of material);
(4) Why: design aspect (layout, materialization, form, signal); (5) *Who:* user (owner, designer, consultant, contractor, etc.); (6) How: type of computer manipulation (graphical, text, numbers).

Similar, larger, studies are part of the IOP-GOM-CAD-project at the Eindhoven University of Technology and of the IDEF-1-project at TNO in Delft. Bryan Lawson's (1980) work is an important forerunner in this type of study.

Above all, it should be realized that integrated computer use implies integrated design, meaning design much closer linked, particularly at the early design stages, to related expertise such as costing and environmental and structural engineering.

14.3 Innovation

Almost all current use of computers and most of its research and development is directed at computerizing existing tasks in the architect's office. This may result in significant shifts in time spent on particular tasks, provide more information at some design stages and influence the amount of communication between people inside and outside the office. However, none of this principally innovates architectural design. This applies equally to expert systems when applied to well-structured tasks only, as will be the case for most initial applications.

Others may mention such true agents of innovation as the possible restructuring of building design information in 'frames', which may include visual images, thus coming close to Alexander *et al.'s* (1977) 'patterns'. Also new insights in design logic may come from the application of knowledge engineering to the design process, or the possible revival of design methodology, as a result of the application of new techniques for systems analysis and software production and maintenance, may lead to more fundamental changes.

Here the author would like to focus on one particular aspects of innovation which specifically concerns the role of the architect. Design is considered to evolve from a specification of required performances to a plan for materialization. In practice it is a very discontinuous process and the information transition from performance specification to definition of material is ill managed. In the early design stages in particular one is not trained to think in abstract terms of performance, but in materializations such as the reference to a building product or a design solution.

Much of the iteration in design consists of replacing a chosen material, product or structure by another, and 'trying again'. Often this results in a mismatch between the specific design stage and the definition of the design produced. In traditional design all this is not apparent and may cause little harm, since every design definition (drawing or written specification) is produced anew many times throughout the design process. However, in CAD one aims to re-use as much material as possible from previous stages. In CAD a too precise design definition will be more difficult to alter later.

If design is seen as matching performance specification to materialization (and the problem is that our performance specifications do not result in a one-to-one match with materialization possibilities because specifications are global and abstract while materializations are not) then what we need is more global and abstract materialization definitions. Such definitions are conceivable as feedback from materialized designs, and some already exist in terms of reference constructions or reference buildings in certain costing programs.

The result of the above is that one sees the emergence of two different design processes - one that outlines the performance specifications and another that results in a plan to build. As the design process becomes shorter through the use of computer aids, the present recurrent 'jumps' from performance to material specification may concentrate into one transition moment that can be automated. This may subsequently lead to two separate types of designers: the 'functional designer', advising the client on design options, resulting in a sketch design and performance specifications, and the 'material designer', who makes the choices on specific materials and solves relational problems between materials, products, constructions, etc. Possibly the 'functional designer' is part of the client organization, and the 'material designer' works for the builder (Figure 14.4).

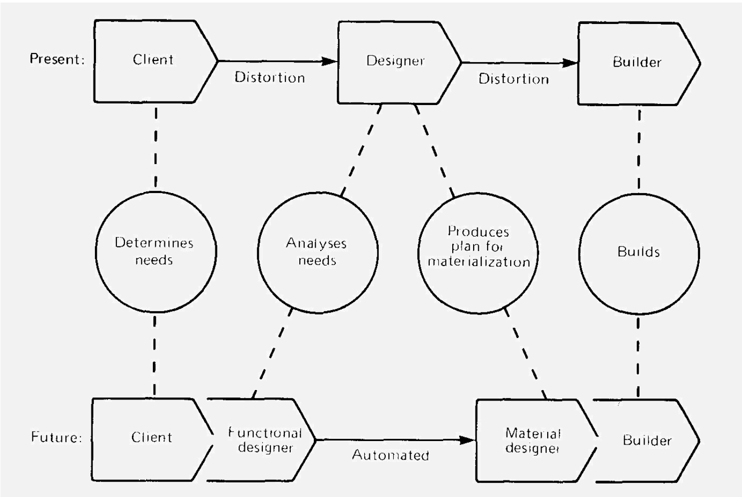

Figure 14.4. Possible future separation of the functional and material designer

Such ideas may seem to imply the death of the traditional architectural organization. This, however, should not be confused with the death of architectural design as a profession. With design roles likely to shift to others through the impact of computer use, in particular where the separation between technical advisors, economic advisors, designers and building contractors is concerned, designers should concentrate on the potential enhancement of their profession through the use of computers, and not cling to the way this profession is currently organized. Hopefully, professional organizations will then act as agents of innovation and not as protectors of the status quo.

If readers find the above ideas far-fetched they should be aware that a new generation of designers is approaching for whom computers have existed since they were born. They will be free of the threshold fear that we unconsciously harbour in our thinking of what computers can and cannot do. What we are currently doing is laying the foundations for that generation.

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