Comparative floorplan-analysis in programming and architectural design

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Abstract

Every floorplan may be regarded as a reflection of the goals and activities of the users as interpreted by the architect. By comparing a wide range of building layouts for similar organizations one may achieve a good understanding of the ways in which goals and values can be expressed in spatial solutions. It offers the opportunity to develop a spatio-functional typology of design solutions. Post-Occupancy Evaluations focussing on underlying arguments and user experiences with different design solutions give insight into relevant points of decision, (dis)advantages for use and perception, and (dis)congruencies between spatial systems and social systems. This article demonstrates how an integration of Comparative floorplan-analysis (CFA) and Post-occupancy evaluation (POE) may contribute to more soundly based solutions in programming and architectural design. The relationship between spatial and social configurations is illuminated by an analysis of floorplans of two schools with different educational systems and the spatial implications of a shift from a medical care concept into a residential care concept in nursing homes.

Keywords: spatio-functional analysis; floorplans; design evaluation; POE

1. (Dis)congruency between spatial and social systems

Buildings are the final result of an often lengthy and complex decision-making process. In all cases a translation is involved of points of socio-cultural objectives into a spatial architectural form, making allowance for constraints such as time, money, and legislation. Buildings may thus be interpreted as the reflection in stone of ideals, objectives, considerations on how to support desired activities and feelings of wellbeing of its users, and compromises. When the design accords with the preferences of the users and the building supports the desired activities in an appropriate way, one may speak of congruency between the spatial system and the social system¹. If on the other hand activities cannot be efficiently performed, or the manifestation does not match the culture of the users, then incongruency exists. An example of incongruency is a business with a corporate identity of modernity and high tech, housed in old-fashioned premises. Or a gallery-access flat with the front door, kitchen and a bedroom on the gallery side and the living room plus other bedrooms on the balcony side. Here the spatial configuration differs from the usual transition from public to private via front door - hall - living room - kitchen - bedroom. Front and back functions (front-stage: representative and recognizable, back-stage: quiet and private) are intermingled. Incongruency can lead to inconvenience and annoyance or worse: reduced productivity (e.g. increased absenteeism in sick buildings), stress and expensive retrofits.

2. CFA and POE in design studies

To achieve optimum congruency between spatial systems and social systems investigation of objectives, values, standards, activities and preferences of future users in advance, in the programme and design phase, is indispensable. Bechtel² speaks in this context of pre-design research. Evaluation afterwards can make it clear how the building is actually used and appreciated. Such post-occupancy evaluations or POEs are meanwhile used on a fairly wide scale³. Pre- and post-design research can lead to a sound theoretical framework for drawing up performance requirements, designing “with people in mind”⁴, checking preliminary designs on behavioral consequences, and developing standards and design.

Social scientists use observation methods, interviews and standardised surveys in POEs. The formal and architectonic aspects are discussed in a rather limited way or even not at all. Furthermore research data are seldom linked to alternative design solutions. Architects usually look in a different way at designs and buildings. Their interest in precedents is directed primarily towards the formal structure and the materialization. By analysing precedents an attempt is made to discover a formal typology, from which inspiration can be drawn for their own design⁵. These typologies are mostly focused on the main building layout, with only minor attention to site characteristics or forms and boundaries of separate rooms. Functional aspects are often underexposed. Evaluation of behavioral consequences is even lacking completely in most cases.

Therefore we plea for a combination of the strong components of the two approaches. Integration of comparative floorplan-analysis on spatial and functional features and evaluation of (mis)fits to user requirements could eliminate the restrictions of traditional social-scientific research and architectural design analyses. Comparing a wide range of floorplans of buildings with more or less the same function is in the first place a search for similarities and dissimilarities in patterns of spatial relationships i.e. the way that essentially identical functions or activities are accommodated from one floorplan to another. This can help to track down typologically different design variants. Actually floorplans embody the social nature of the building through which it localizes people and modulates their interaction. The next step is to understand why differences in design solutions occur, by linking the design alternatives to data from POEs on the underlying arguments and experiences of users. This gives insight in relevant points of decisions and (dis)advantages of design variants for use and perception. The process is of an interactive and iterative nature and should be passed through in various orders. On the one hand the research is guided by hypotheses, questions and notions of designers and their clients, data from POEs, review of literature and so on, and also of the researcher's own hunches. On the other hand the plans themselves generate ideas and hypotheses which can be checked in the other sources.

As a result of this process spatial architectural choices become more understandable, recognizable and debatable. Behavioral aspects can be coupled directly to design variants, while sufficient freedom remains for making conscious choices on one's own for the most suitable design. A decision-making framework of this kind can clarify and accelerate discussions in the programming and design phase of new building initiatives.

Figure 1: CFA and POE in design studies

Experience with the integration of CFA and POE has been gained in research into health centres⁶, child care centres⁷, hostels and daycare centres for mentally handicapped people⁸, and buildings for housing and care for the elderly^{9,10}. Through systematic comparison of similarities and dissimilarities design variants were traced. By means of literature search, interviews with experts and site visits the objectives and expectations of the initiators became known. Actually the design-process was passed through in reversed order. From existing buildings a search was made back from the building to the design, the brief, and the first initiatives, in order to explain relations between spatial architectural choices and socio-cultural objectives. By means of post-occupancy evaluations the insights were intensified and consequences of design decisions for use and perception were traced.

3. Items for integrated analysis and evaluation

A guide to an integrated approach in pre- and post-design research may be a matrix, with spatial and functional features indicated in the columns, socio-cultural goals and values in the rows, and their interrelation in the cells (Table 1).

Accordingly, two routes may be taken:

- a. from row to column: what is the optimum spatial architectural translation of the socio-cultural goals of an organization, in this case those of principal and users; this question is especially relevant to the *development* of a design;
- b. from column to row: to what extent will different design solutions correspond with different socio-cultural goals; this question is particularly relevant to the assessment of either a design or the *evaluation* of a building that has been realised.

The cyclic process of programming, developing design solutions, and evaluating design sketches as well as buildings realised will enable careful filling in of the cells.

Table 1: The relationship between spatio-functional features and socio-cultural goals and values.

SPATIO-FUNCTIONAL FEATURES	SITE	BUILDING	ROOMS
	- location - access	- outline - entrance(s) - materialization	- form / measures - boundaries - relations - finish/furnishing
SOCIO-CULTURAL GOALS AND VALUES	- functions	- functions - control	*) - functions - control
- functionality			
- efficiency			
- aesthetics			
- privacy / social contact			
- identity			
- accessibility			
- safety			
- adaptability			
- etc.			

*) The legibility of floorplans with respect to this information is often limited.

a. Spatio-functional features

Plans of sites and buildings, in which is clearly indicated where the various activities are located, form a useful database for a first insight into the building characteristics (form and materialization) and the functions of a building and its individual rooms. Three different levels can be distinguished: site, building and rooms.

Site

By site is meant the location of the building and its position in the immediate surroundings. Site variants and concurrently relevant points of decision-making for both principal and designer may include: position either in the inner city or in a suburb,

in a homogeneous residential area or one with a considerable mix of functions, along the motorway or in a woody environment. Variants for the immediate surroundings of the building are for instance with/without private outdoor space, parking facilities on privately-owned grounds or in a public square with a stony or green layout

Building

Relevant variables are in particular: outline; number and nature of entrance(s); internal access; zoning, or the spatial clustering of related functions; the position of spaces on the north or south façade; design; materials used for the outside, and the structure of management.

Rooms

Relevant characteristics are the shape and size of spaces, the nature of boundaries, materials applied, inside/outside relations, the interrelation of spaces.

b. Social-cultural goals and values

Spatio-functional features may be regarded as a reflection of the socio-cultural goals and values of an organization. Goals and values refer to the basic view from which to work. For schools this is for instance the view of education taken, for nursing homes the concept of care. Other examples with different spatio-architectural consequences are pedagogic ideas (child care centres), ideas about health care (health centres, hospitals) and ideas about business organizations (offices and firms). The socio-cultural goals mentioned in table 1 will be described in general terms. Virtually all the goals can be realised by social and spatial means. Privacy, for instance, may be guided by means of spatial separation or connection, but also by agreements to knock before entering, or by indications such as 'staff only'. This article will only deal with spatial means.

Functionality

A product or process is called functional when the means which are used are suitable to it's purpose. With reference to buildings functionality may be defined as the degree to which the activities are supported by the built environment. This is related to the

amount and form of space, the spatial relationship between rooms (functional zoning), the routing through the building for distribution of people, goods and services etc.

Efficiency

Efficiency may be defined as the optimal ratio between results and means or output and input. Output may be measured by productivity (number of products per unit of time, number of clients served per day). Important input-indicators are costs of investment, costs of staff, running costs, energy, time, etc. Relevant spatio-functional features with respect to efficiency are for instance the spatial clustering of functionally related activities, short distances and the prevention of physical barriers between spaces frequently used.

Aesthetics

Aesthetics refers to the experience of beauty. A number of decisions concerning spatial features are often mainly based on aesthetic considerations, for instance the shape of the building, the choice of colours and materials for the building facade, application of verandas and atriums. CFA will be restricted to formal and symbolic aesthetics. An analysis of sensory aesthetics (light, sound, colours etc.) requires additional information.

Privacy and social contact

Privacy may be defined as the personal check on and selective control of access to an individual or his group¹¹. Privacy and social contact are two sides of the same coin: self-determination and freedom of choice in entering into or avoiding contacts. Too little contact leads to feelings of social isolation, too much contact leads to feelings of crowding. Three forms of privacy may be distinguished:

- visual privacy: freedom of choice in perceiving visual stimuli;
- auditive privacy: freedom of choice in perceiving auditive stimuli;
- social or territorial privacy: the possibility of a personal check on social contacts through spatial connection or separation; a relevant aspect is personalization: the possibility of marking the environment as one's own, so that the environment becomes less public and more private.

The degree of achieved privacy can be read from floorplans inter alia by indicators such as the availability of rooms for individual and communal use and the openness or closeness of physical partitions.

Identity

Identity refers to the degree in which a person, group or organization succeeds in expressing its essential characteristics in a recognizable way. Among the spatial means to strengthen an organization's identity are a prominent location (in a famous square, near other important buildings), or a conspicuous design and choice of materials. A means often applied to express the high status of separate rooms within a company building is the convenient location of someone's room as to entrance and outdoor space (a fine view, plenty of sun, private outdoor space), ample floor space, different form of the room, the use of colours, or a handsomely designed nameplate.

Accessibility

An environment is accessible when everyday users and visitors are able to participate in various activities without any difficulty. In this respect two components are important:

- Psychological accessibility: to what extent does a building 'invite' the potential user or visitor to come in, make use of the building and of the activities going on inside. Relevant spatial aspects include a recognizable entrance, clear transitions from public to private; environmental characteristics which facilitate spatial orientation, such as a clear outline of a building, visual axes, points of recognition, differentiation in the use of colours and materials.
- Physical accessibility: the ease with which users and visitors can reach, enter and move through a building, thus being able to use its various spaces. A focal point in particular is integral accessibility, which means that people with physical disabilities can also enter and move through the building independently, just like others. 'Access for all' can be read from floorplans by indicators such as the sizing of rooms and passageways and how differences in level are bridged (stairs, ramp, lift).

Safety

Safety is the actual or perceived presence of protection against actual or perceived danger. A distinction can be made between ergonomic safety (least possible danger of falling, damage etc.), fire safety, structural safety and public safety (least possible danger of actual occurrence of crime and fear of crime). Relevant characteristics at floorplan level are for instance the public-private gradient, and the degree of compartmentalization.

Adaptability

Adaptability is the ability to change in response to new conditions. As far as the building is concerned it means for instance the ability of the building to adapt to changing activities or the space required (other, more or less). Adaptability can be read at various levels: the site (e.g. the possibility for extending), the building as a whole (e.g. horizontal and vertical extensibility), and the individual rooms (e.g. movable, non loadbearing walls or folding partitions)

Apart from goals and values economic and legislative constraints play an important role in the design process. Effects of these factors can be read from floorplans, too, and may explain many decisions. So both in developing plans and in comparative floorplan-analysis these constraints should be taken into account very carefully.

c. Connection between spatio-functional features and socio-cultural goals

Ideally, it should be possible to place typological variants in relation to one another in such a way that a yardstick comes about, showing to what extent a certain socio-cultural objective may be realised or particular values may be expressed by different spatial solutions (ranging from strong to weak congruency). With reference to such a yardstick for each of the three levels of scale distinguished here it will be possible to read from a floorplan to what degree a certain objective has been realised or was of obvious importance. Conversely, such a yardstick can help to choose the optimum design solution for a certain socio-cultural objective. To illustrate this (an initial step for) such a yardstick has been developed for the privacy aspect, with typological

variants on the three separate levels of scale. Some solutions only apply to one of the three forms of privacy (visual, auditory, territorial), others may relate to more than one form.

Site

Variants for a solution with different, increasing degrees of privacy are for instance: location on a busy public road in the centre of a city versus a location on a quiet cul-de-sac in a suburb (more visual as well as auditory and social privacy); no /abrupt /gradual transition from public to private grounds, for instance the entrance of a building immediately on the pavement versus a modest transition via steps or a small front garden, or a more extensive transitional area such as a drive or a large front garden surrounded by a moat, fence or hedge.

Building

A series of variants of solutions with descending degrees of territorial privacy is for instance: the single house > semi-detached house > terrace-house > flat in a composed building with private front door > private room without a private front door in a communal house > commonly-shared living and bedroom in a nursing home (figure 2). With the latter example we arrive at the level of separate rooms.

Rooms

With regard to the individual or common use of space it is the nature of the boundaries that determine to what extent users themselves can influence the desired level of social contact, visual, auditory and/or territorial. The connection or separation between the space for two persons or activities may differ from a totally open connection to totally closed boundaries (figure 3).

As mentioned before this analysis was restricted to privacy. Of course a similar analysis should be executed for the other socio-cultural goals and values.

Figure 2: Building variants with descending degree of territorial privacy

Open connection without any separation:
no visual and auditory privacy, hardly any territorial privacy;

A transparent partition:
visually open, no possibility to control visual stimuli, little auditory protection and territorial privacy;

Ditto with curtains or Venetian blinds:
visual contacts can be controlled in accordance with need, no auditory improvement;

Flexible partition (folding/sliding):
ample possibilities of controlling territorial privacy and restricted auditory privacy;

Permanent partition with communicating door:
some control of visual as well as auditory and territorial privacy

Closed and permanent partition:
high rate of protection against undesired contact, no possibility for desired contact

Two rooms a distance apart: high rate of protection against undesired contacts, with an extra barrier to desired contacts

Figure 3: Variants for separation/connection between two persons or activities, with an increase in privacy and a decrease in desired direct contact

5. Examples

5.1 Congruency between educational systems and school buildings

This case briefly considers a study of the spatial organization of schools with differing educational systems for children of 4 to 12 years. Comparative floorplan-analysis of primary schools shows a number of interesting differences, such as:

situation: schools situated in greenery as a school island or expressly integrated into the surrounding residential neighbourhood;

main layout: grouping of the classrooms around a communal central area or placing the rooms side by side along corridors;

spaces: one communal main entrance or separate entrances for lower school and upper school.

Now an interesting question is to what extent these differences in spatio-functional configurations can be traced back to differences in educational goals and values. In search for an answer a number of floorplans of schools with different educational systems have been collected¹². Of all these types viz. Dalton, Freynet, Montessori, Rudolf Steiner and Jenaplan, relevant educational points of departure, objectives and methods have been analysed. CFA makes it clear that some spatial conditions are bound up with certain intrinsic objectives. We shall clarify that with two striking examples.

The **Jenaplan** system emphasizes the social development of the individual. For this reason discussion as a form of communication within the heterogeneous group and the organization of common activities within the whole school are important elements in the educational system. Group discussions and encounter with others lead to mutual understanding and tolerance. Instruction and digestion of the subjects taught takes place in groups and subgroups that cut across the regular group. Openness forms a key concept in this both towards the others in the group and with regard to the world around us (knowledge of the world). In this case neither the group's nor the individual's objective for privacy is particularly stressed, the group's own identity does not require much attention either, partly because the composition of groups will vary frequently.

The **Rudolf Steiner** system develops its pedagogic approach from an anthroposophic portrayal of man. That is to say, the development of the individual is not seen solely as a product of heredity and environment but also of one's own individuality. The individual development of each child is rendered possible by creating a climate of certainty and security in a stable environment of one's own group. In addition to the emotional development expression and eurythmy play an important part. In this school there is clearly a need for the group's own identity, each group needing more privacy. By means of two characteristic floorplans the congruencies between spatio-functional configurations and education systems will be illustrated.

Lisse (Jenaplan)

This school is situated in the transitional area between high-rise and low-rise apartment blocks, near the district's play and recreation area. On the south and west side there is a large open play area. The main layout of this school consists of the central hall type with orientation towards the central midsection of the building (figure 4).

Figure 4: Jenaplanschool, Lisse

The central point of interest is the Encounter room in the communal public area. Further, there is one central entrance with a division into lower school (4-6 years) and upper school (6-12 years). Each unit has a communal toilet group with the possibility of visual contact for the infants. The toilet groups for the middle school are located at a rather remarkable internal spot in the building. There is no differentiation of the communal space according to individual workplaces, corners or places to rest as indicated in the floorplan, but in all probability available. A differentiation in the classrooms is absent, with the exception of the distinction between lower and upper school (toilet groups; entrance). The playroom is designed on behalf of the infants. By means of a folding partition this room is connected with other communal rooms. The open character of this layout offers the possibility of breaking up the group composition. There is no separate hall for physical education/sport for upper-class

children. The internal traffic space is undifferentiated, the transition between classrooms and central spaces is a gradual one.

In conclusion, attention to the social aspect (openness and encounter) is spatially shaped by:

- the main layout of the building: a central hall type and one central entrance
- the presence of a central encounter room
- the relation between playroom and communal space
- the undifferentiated nature of the communal space
- the undifferentiated nature of the classrooms
- communal, multiple and multifunctional use of space.

To a much smaller extent the open nature is reflected by

- the inside/outside relation: the distance between entrance and classroom is in some cases quite considerable. This increases the danger of nuisance for other pupils (e.g. during the breaks) and
- the relations between classrooms: a direct relation (and thus easy interchange of contacts) is absent.

It is certainly justified to draw the conclusion that little attention has been paid to the group's privacy. The groups' own identities have not been emphatically supported by the building.

Meppel (Rudolf Steiner School)

This school is located in the centre of a small provincial town, at walking distance from the station. The accessibility of this regional school is important. The building consists of two floors, with the older children on the first floor, from which they can familiarize themselves more with the outside world (figure 5). The staffroom is in the central part above the entrance with a good view of the school playground.

Figure 5a: Rudolf Steiner School, Meppel, ground floor

Figure 5b: Rudolf Steiner School, Meppel, first floor

With regard to the main layout the use of the pentagon, or to be more exact the non-rectangle, is most conspicuous; decidedly present in every Rudolf Steiner School. There is no central hall; instead a corridor system has been opted for. There is a clearly

recognizable tripartition, which finds expression in three more or less separate units accentuated by an entrance of their own, a compartmented corridor of their own (internal traffic space) or a floor of their own. In short, a highly differentiated building! There are several entrances including two main ones. With regard to the communal spaces there are no possibilities for spontaneous encounters. There is, however, communal room present for expression or eurhythmics as well as for gatherings. Identity and recognizability of their own are the clearest characteristics of the classrooms, but still there is a common recognizability through the form of the pentagon or heptagon or variants of these. The strongly private nature of the classes comes to the fore in closed walls and highly individualized rooms, no mutual contact, emphasis on own identity, finding expression in the class in the almost isolated spaces, in both an acoustic/visual and a territorial respect. See for instance class 2 with adjoining toilet plus office and class 1 with patio and storage/electricity supply, through which a view of other rooms or circulation areas is completely and deliberately blocked (Figure 5).

The outdoor playground consists of a communal space for all classes, intended for motoric exercises and free expression. A specific point in the floorplan-analysis is that the classrooms are hardly if at all larger than the rooms that we encounter in for instance the Jenaplan school. This is despite the apparent economizing on internal circulation areas. In other words, if the classrooms are so important, why have not more square metres been invested in them?

In conclusion, the building may be regarded as a clear, spatially designed concept of the ideas and pedagogic points of departure of the Rudolf Steiner educational system. Everything revolves around the core concept of privacy, which is spatially translated into:

- main layout of the building
- division into several units clearly separated from one another with
- several entrances
- highly private classrooms with
- own identity of the individual rooms (own door, own department, specific design)

- the deliberate absence of direct relations between the classrooms and the absence of joint use of space (but multifunctional use of space) with consequently
- a not very flexible and rather traditional building (corridor with adjacent classrooms)
- strongly directed towards the privacy of the individual groups.

One would have expected the toilet units to be located in the vicinity of the individual classrooms. This would have made a positive contribution to the private nature of the infant classes.

Table 2 shows how, under the influence of differences in pedagogic/didactic goals and values, considerable differences can occur in the spatial solution.

Table 2: Spatial differences between two educational systems

	Jena	Rudolf Steiner
Main layout		
recognizable, separate units	-	++
one central entrance	+	-
several entrances	-	+
central communal area	++	-
Classrooms		
recognizability, identity	-	+
openness	++	-
privacy	-	++
Relations between rooms	++	--
Specific rooms		
movement room (all classes)	-	+
movement room (specifically for the lower school)	+	-
Use of space		
joint use of space	+	-
multiple use of space	+	+
multifunctional use of space	++	++

5.2 Privacy and social contact in nursing homes

Initially relatively little attention was paid in nursing homes to the patient's privacy. The *medical care concept*, with the emphasis on treatment and nursing, predominated. In the course of the years it has increasingly come to be realized that elderly people in a nursing home stay there for a relatively long time (from several months to sometimes

several years) and that the home is their last address. Hence many advocate a *residential care concept*, with greater emphasis on residential functions, privacy and autonomy of the patient/resident. A comparative analysis now being performed on a series of buildings for nursing homes ranked by year of construction aims at revealing how these changing views are translated spatially and architecturally¹⁰. We briefly check the findings for the privacy aspect by means of a number of building characteristics distinguished in Table 1.

Site

As regards location, a tendency is becoming apparent to integrate nursing homes more than before into the 'normal' residential districts, so as to strengthen contacts of nursing home residents with society and vice versa, actually or symbolically.

Building

Comparison on structural dimensions shows that advocates of greater privacy and social contact often expressly aim at scaling down, an articulated structure and a limited number of storeys on behalf of better contact with ground level and thus with 'society'. An example is the De Bleerincx nursing home in Emmen (Figure 6a and 6b).

Articulation is a means of scaling down within a large organization. As a result groups can be individually recognized more easily. This gives the groups a more private character. The other side of the coin is that people live very much on top of one another, so that social control can become too great and privacy is at issue. Actual scaling down can be seen in projects for normalized living for (slightly) mentally retarded elderly persons. An example is the Anton Pieckhofje in Haarlem (Figure 7).

Rooms

The increased attention to privacy and social contact can be seen from both the nursing departments and the supporting areas. Older nursing homes usually consist solely of nursing departments with long straight corridors, with on both sides the bedrooms and service rooms, and a block for facilities (kitchen, technical service, management and administration). In short, a hospital designed as efficiently as possible.

Figure 6a: De Bleerinck Nursing Home, Emmen

This nursing home for 186 psychogeriatric patients consists of 6 wards along internal streets, ending in a central area with all common facilities. The identified building layout strengthens the autonomy of the different wards. The central location of the common facilities aims to support social contacts between the patients, both mutual and with the outside world. Several facilities (inter alia the shop and bar) are also open to residents from the neighbourhood

Figure 6b: One of the wards of De Bleerinc, Emmen

In order to create an atmosphere of intimacy and (group)privacy this ward has been subdivided into three units, each with its own living room and sanitary provisions. The entrance door to the ward is locked and supplied with a door bell. The three units differ in level of care needed by the residents. The most healthy patients are located backstage. This unit has another internal entrance door and two living rooms, in order to strengthen privacy and autonomy.

Legend:

1 bedroom (1 bed)	K kitchen
2 bedroom (2 beds)	C common facilities (restaurant, library.
4 bedroom (4 beds)	bar, hairdresser's saloon etc.)
L living room	N counter/nurse's room
B bathroom/restroom	S staff
CB common bathroom	

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Figure 7: Anton Pieck Hofje, Haarlem

This small scale home for 36 psychogeriatric residents consists of six houses around a patio. Six residents share a common living room, kitchen and bathroom. Each resident has its own (small) bedroom. The project has not been built according to the legislation of nursing homes but according to legislation of housing. It aims to offer a form of 'normalized housing' for residents suffering from a moderate level of Alzheimer's disease.

Modern nursing homes are characterized by the presence of sitting areas, a small shop, hairdressing salon, restaurant and recreation room. The corridors in the departments are less austere, with recesses where people can withdraw for a while without losing contact with fellow-residents. In addition, there is a clearer but also more gradual transition visible between the more or less public area of the main access, the semi-public nature of the internal access to the nursing departments and the private nature of the sitting rooms (primarily for one's own group) and the bedrooms (primarily for the individual or two to four residents). In short: an environment geared as much as possible to the individual, with the emphasis on privacy and social contact. See for instance one of the nursing wards of De Bleerinck (Figure 6b). A striking feature is the presence of various living rooms. This offers good possibilities for social contact, while through the scaling down (instead of one lounge for 30 persons four sitting rooms for small groups) in addition a certain intimacy and group privacy is guaranteed. In contrast to former times dormitories for six and more patients no longer occur here or elsewhere in The Netherlands.

Another striking point is that in modern nursing homes more attention is paid to the relationship between bedroom and sanitary facilities. In older homes it is a regular occurrence that residents have to cross a rather public corridor to go to the bathroom or toilet. In recent homes the relationship has in many cases been made more private by directly connecting the bathroom to the bedroom or by a link via circulation area for one's own little group (see for instance Figure 8).

As regards finish and furnishings a greater freedom can nowadays be seen in furnishing residents' rooms in part with personal belongings (own chair, cupboard, bedspread). Variation in colour and use of materials for walls and floors enhances the identity of the rooms and reinforces the private character. As stated, the finish and furnishings cannot be properly seen from floorplans.

Figure 8: One of the wards in St. Elisabeth, Amersfoort

By the location of the sanitary units the circulation area between bedrooms and restrooms gets a semiprivate character.

6. Application in programming and design

In general, limited and often rather implicit use is made of floor plan analyses. It usually amounts to the principal comparing his experiences of the solution(s) well-known to him with the desired new solutions, of which he usually knows only few possibilities. The architect, too, makes primarily use of experience gained from his earlier or similar projects. Explicit application of CFA can help to get a more complete view of all kinds of possible solutions. Combination with POE will give insight in the most desirable solution. Research based knowledge of the linkage between design issues, concept and form in design and (mis)fits to socio-cultural objectives may evoke relevant ideas for current design solutions, leading to ‘precedent-based design’^{13,14}.

In short the proposed integration of both methods can improve the design process in the following ways:

- as a decision-making framework for principals, prospective users, and architects, in different stages of actual building processes: programming, developing design sketches, assessing alternative design solutions relative to each other and to the stated problem, ranking and weighting alternative design solution¹⁵, combining sub-solutions¹⁵, making final decisions;
- as reference data in post-occupancy evaluations, e.g. for formulating hypotheses or confronting users with alternative design solutions and asking for their comments;
- as input data for a precedent based computer library of designs;
- as a means to develop design guidelines for programming and designing, in the form of checklists, do's and don'ts, annotated design solutions, and patterns as Christopher Alexander et al ¹⁶ have developed earlier.

Another area of application is teaching architectural design on the basis of scientific knowledge. For instance the results of CFA+POE could well fit in a multi-criteria evaluation of design alternatives such as WOMBAT, a computer based tool to support students learning about design evaluation¹⁷.

7. Concluding remarks

With this contribution we have tried to demonstrate that a combination of CFA and POE can provide a clear insight into the link between spatial architectural means and socio-cultural goals and values. This may be an important addition to the traditional socio-scientific research methods, such as interviews and observations, and design research purely focussing on developing formal typologies . By CFA+POE behavioural aspects can be coupled directly to design variants, while sufficient freedom remains for making conscious choices on one's own for the most suitable design. Moreover, this integral approach gives designers an opportunity to support their way of looking at buildings and notably at floorplans more methodologically.

Comparative floorplan-analysis can be applied in several ways:

- Within one functional building type, floorplans per se can be compared with each other on a number of physical properties related to social characteristics such as confidentiality and privacy, communal use of space, zoning etc.
- Comparison between different functional building types such as schools, nurseries, libraries and health centres is also possible.
- Comparisons can be made synchronously (looking for cultural or regional differences, for example) and diachronously (looking for developmental changes).
- Results can be used to develop or to improve external criteria like guidelines, standards and users' requirements.

CFA is of course confined to those spatial means that can be read from floorplans. The influence of aspects like colour, use of materials, the third dimension, furnishings and fittings on the organization and the actual behaviour of people and vice versa cannot be measured in this way. CFA is therefore meant above all as preparation for and integration into POE studies.

Initially the comparative floorplan analyses we performed in the main manually. Meanwhile the necessary software has become available for proceeding in a more advanced manner. By entering floorplans in the computer it is, for instance, fairly simple to perform floorplan analyses. In particular Space Syntax¹⁸ and Architectural Knowledge Systems^{19,20} are envisaged for this. Space Syntax makes use of network analysis to trace links between the morphological structure of the built environment and the social structure. AKS utilizes advanced software to record and represent architectural knowledge of buildings and building elements. It is the intention in the near future also to involve other methods in the research.

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