Architectural Patterns enabling Reconfigurable Exit Routes for Complex Buildings

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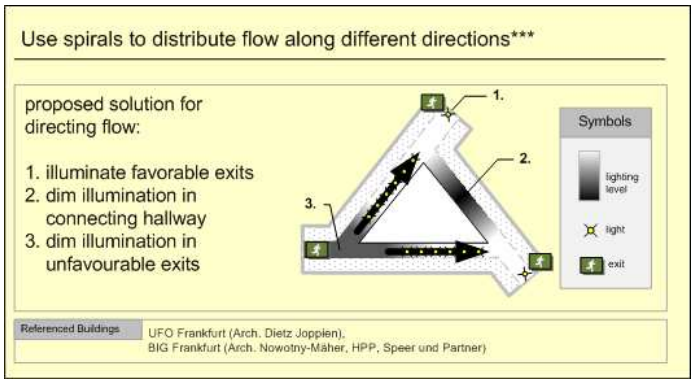

Fig. 1. Example showing a circulative pattern for directed egress

Summary. Architectural legibility deals with the understanding of built space. Besides being important in normal day-to-day operation of a building, it becomes a real factor when dealing with egress situations: Occlusion of escape signage, ambiguities in the escape route and lack of orientation can prevent a rapid and orderly evacuation [1].
In our work, we wish to tackle the problem of legibility from the standpoint of architectural planning. We focus on multi-storey buildings with diverse floor layouts and complex interior (mixture between open-plan and cellular structure), as is the case with hospitals and office buildings. Our novel contribution to the field of pedestrian traffic and evacuation dynamics is to bring forward a set of architectural patterns[2] (refer to Fig. 1) that can be used to avoid ambiguities and disorientation when di-

recting groups of evacuees to different exits using reconfigurable exit signs[3]. Our patterns focus on the circulative situation, enumerating parameters (e.g. lighting, visibility) that need to be controlled in order to assure an intuitiveness of the egress situation and support the directed flight. Additionally, we list examples of buildings using this circulative pattern. Our research is part of the Working Papers[3] project, a continuing effort to compile a catalogue of circulations in public buildings.

Keywords: Architecture, Evacuation, Patterns.

1 Previous Work

Several Books [4][5] list best practices in architectural planning, yet none of them specifically targets circulative design to ensure safe egress. As an example, take Neufferts Architects Data, which brings forward practical planning guidelines for a variety of building types, drawn from a multitude of sources (e.g. architectural experience, norms and regulations, project requirements etc.). From looking at the book, it is evident that the authors wanted to make use of schematic drawings to depict of concepts that would otherwise be hard to grasp (e.g. positioning of exits according to different building uses). However, they are focused on the building type rather than the circulative situation within the building. We are convinced that, in egress, there is need to focus on architectural situation in close proximity to the evacuee, rather than on the building structure or type, which is also what other researchers from Pedestrian Dynamics argue for [6] [7].

2 Elaboration

Our work deals with directed flight along one of many evacuation routes in a complex building, which can be obtained by the use of several mechanisms:

- *Control over lighting levels* may be used in order to visually emphasize the preferred flight direction. Additional use of lighting animation (e.g. runway lights) may further help to decrease the time people spend hesitating in which direction to go, thus ensuring an earlier begin of the egress.
- *Control over visibility* can be used for two purposes: First, to decrease visual ambiguity in spaces that offer two possibilities for egress. Second, to visually introduce a separation in otherwise linear corridors, thus making it possible to direct people along this corridor to different exits.

[3] Apart from the obvious case of fire, this can be beneficial for balancing the traffic along the vertical escape routes, thereby avoiding congestion. Furthermore, we may reserve certain exits to evacuees with certain physical abilities (e.g. slow-moving patients, staff, visitors etc.).

- *Use of barriers*: the built environment can be used to divide and recombine a flow into several different parts, which can be directed to different exits.

Our work represents a pre-study for a research application; therefore, we have invested some thoughts on how to gather and compile work on this subject in a form that architects would prefer. Using Alexander's notion of patterns [2], we went on to develop a showcase pattern language for circulative design (see Fig. 2) that defines eight different patterns. The patterns themselves bring together data from the research community in the form of citations, schematic diagrams for the circulative situation and examples of previously built architecture as a reference (see Fig. 1). Furthermore, as in every pattern language, each pattern has a description, an estimation of its applicability in the form of one to five stars and references to other patterns.

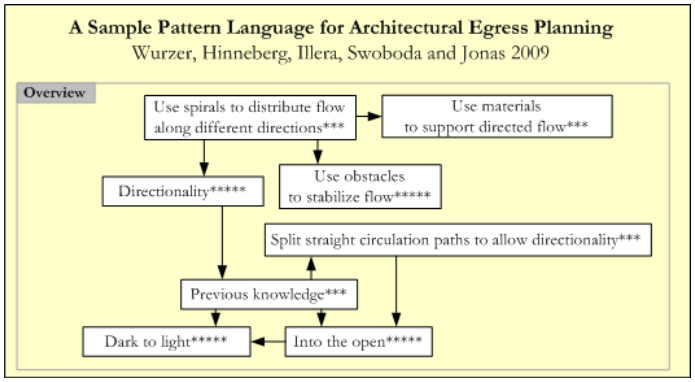

Fig. 2. A pattern language for enabling directed egress

A brief description of the patterns used:

- *Use spirals to distribute flow along different directions**** (also see Fig. 1): Spirals can be used as distribution points, using illumination to direct attention to the preferred exits.
- *Use materials to support directed flow****: Feel of touch and visual perception of material is taken into account by architects when doing design. However, materials can also support directed egress (people hold ontowalls, avoid touching glass etc.).
- *Directionality*****: Flight is per se directional [8], since people tend to prefer turning in one specific direction (left = 60%, right = 40%). Obviously, this needs to be taken into account.
- *Use obstacles to stabilize flow*****: Mixing of pedestrian flows leads to the occurrence of bulks, a strict separation of these by the use of obstacles is the basis of an orderly and rapid evacuation.
- *Split straight circulation paths to allow directionality****: Straight circulation paths can be split visually in order to allow for directed egress. This

applies foremost to smaller circulations which are not considered main routes of egress.

- *Previous Knowledge****: Previous knowledge of circulation highly influences the choice of exit route. People prefer to evacuate through routes already taken, therefore, egress routes have to be established in the mind of the occupant before being effective. Establishing this knowledge has positive effects on the total evacuation time.
- *Dark to Light*****: People flee from dark to lit areas. Furthermore, increasing the lighting level increases the travelling speed of occupants.
- *Into the open*****: People flee from narrow spaces to wider spaces, or generally: into the open. This can be used to direct perception, and, as a matter of fact, choice of exit route.

3 Conclusions

Our work applies findings originating from the pedestrian dynamics community to architectural planning. As format of communication, we have chosen to use Chistoper Alexander's "Pattern Language", a method that is nowadays widely known not for its application in architecture, but rather as a communication tool for structuring of computer software [9]. In addition from citations, we use schematic diagrams to depict circulative situations. We further mention existing buildings where these situations can be encountered, such that a planning architect can also understand the context of the presented pattern.

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