

A Framework of Place as a Tool for Designing Location-Based Applications

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Abstract. This paper contributes to a more enlightened conception of location and thus enables design of more suitable location-based applications. On the basis of the understanding of place within architectural practice, it aims to identify and conceptualize a framework of place. By interviewing four architects, the paper develops an empirically grounded understanding of the structures and properties of place that influence their conception of how human beings perceive their presence in place. On the basis of this understanding, the paper proposes a new framework of place. The framework supposes the ability to inform the development of location-based applications. As a proof-of-concept the framework is used as a source of knowledge in the conceptual design of two different location-based applications.

1 Introduction

To render information within our physical surroundings available to applications, which can then tailor their functionality to users, is a dream of combining the physical and digital in a seamless way. This is no trivial matter. In order to make use of context information within a digital universe, it must be available in a formal manner. It is necessary to know which parameters are significant and what meaning they bear with regard to the operation the application is designed to perform. Models are therefore required.

The focus in this paper will be on location which is considered a specific type of context information among a wide range of others [20] just as the focus will be on location-based applications used by humans.

The word model has its origin in the Latin word *modulus*, the diminutive form of Latin *modus*. A location-model is thus a simplified description of the elements significant for being and operating at a location and their mutual relations. In order to build a location-model, it is therefore necessary to know what location comprises of and what relation there exists between its elements as well as the elements relation to the person who experiences the location. To model location from a human perspective it is thus necessary to know which elements signify humans' perception of and interaction with location. Because

humans are dynamic and constantly change their interaction with and perception of locations, it is a balancing act to construct models that are neither too simplistic nor too inclusive for their purpose. Thus, the first step is to acknowledge the necessity of specializing models to their purpose in order to support the dynamic nature of human action and perception [9]. That said there exists some parameters which are likely to be relevant over and over again [14]. Due to our constant cultural preservation through repeating actions as well as the fact that we all are physical creatures who, with few exceptions, all have five senses and the ability to move around autonomously. One possible method to support the constructions of location-models is by presenting substantiated frameworks of possible parameters and their relation to human perception and action. This is the challenge which present paper aims to meet.

The approach used to meet this challenge is to go beyond computer science and consult domains within which there exists an understanding of human relations vis-à-vis location. And to put an effort into translating this understanding into a framework, which can be used directly in a model-creation processes. In this paper, I take a step in this direction. I present a framework of the physical aspects of location, based on architectural perceptions of the relationship between place and the experience of place. This framework proposes to inform the design of location-models for location-based applications. The paper begins by outlining the background and motivation for developing this framework of the physical aspects of location including a review of five different location-models, and a theoretical definition of the concept of location. Section 3 presents a study of architects' understanding of location and humans' relation to it. Section 4 is an outline of the resulting framework of the physical aspects of location. The framework is then used to inform the conceptual design of two location-models for two different location-based applications in section 5, and section 6 concludes the work.

2 Location

The discipline of creating location-based applications and for that purpose creating location-models has been around for a while. There exists several types of applications which are used by a broader population everyday e.g. road navigation systems for vehicles, location-based recommender systems and friend finders. In this spirit researchers have created generic location-models meant to work as platforms¹ for others to design specific applications [2, 4, 7, 12, 18] In their endeavor to create generic models they presumably made an effort to encapsulate accepted and used types of location-information and thus I perceive them as a joint indicator of the prevailing understanding of location. Therefore I have subjected five of the most cited [2, 4, 7, 12, 18] to scrutiny, of which I will now give a brief account.

Earlier reviews of location-models [3, 8] reveal that location-models build on one of two types of location-information, namely geometric/physical or se-

¹ Where 'platform' refers both to conceptual and actual implemented ones.

mantic/symbolic - or on a combination of the two. The geometrical/physical-information is most often represented as sets of coordinates between which the Euclidian distance can be measured [3]. The semantic/symbolic-information, however, refers to properties of location ranging from the topology to the organization of the society encapsulating the location. Semantic-information is often represented as hierarchies e.g. Europe.Denmark.Copenhagen, but they can also be represented as sets or as graphs. The present study revealed a similar pattern.

In the Nexus location-model [2, 11, 15], a location is defined as a room with all of the physical and virtual objects that the room contains. Nexus is designed to deal with locations in physical as well as virtual forms. In the location-model of Dix *et al.* [7], a location is considered to be an artifact's position within a space that may contain other artifacts, with which the artifact in question can interact or by which it may be affected. In other words, an artifact's location is its position and its sphere of interest, which is confined to other artifacts. In the Raum location-model [4], a location or a Raum is an area of a certain size distinguished by a defining communication artifact, and all the other communication artifacts within that area. A Raum is coupled to the physical surroundings only through a semantic label. These three models are primarily concerned with location from the perspective of an artifact and thus with the presence of other artifacts within a defined space. They vary in their way to define the space, but they never go beyond what can be measured in Euclidian distances.

In the Aura location-model [12], location is defined in three different ways: as a space location (e.g. a room), an area location (e.g. the range of a wireless network), or a point location (e.g. an objects position). The suitable type of location is modeled according to the application's need, possibly using a combination of the three varieties. Furthermore, each location can be labeled and thus placed in a human readable location hierarchy. In the Nimbus location-model [17–19], a location is a combination of a physical position and its semantic properties, such as its relation to society. It is possible for one position to have a large variety of semantic properties related to it, which can be drawn from different GIS (Global Information Systems) databases depending on the application's need. These two models do not deal with artifacts present at the location, but offer coupling of the defined space or point and semantic properties which enables human readable location descriptions and, particularly in the case of Nimbus, allow for complex location definitions.

While all of them represent useful location definitions for different kinds of location-based applications they all fail to encapsulate location-information, which is more directly associated with human's presence and movement. For instance, it is not possible for an application to rely on physical characteristics of a room, because these are not captured by any of the models. Hence, the purpose of this paper is to begin a systematic exploration of what location consists of from a human perspective.

From a human being's perspective a location can be seen as the position (or potential position) within the boundary of a space and a place. Space and place, however, is a rather ambiguous pair of concepts. I have therefore cho-

sen definitions in this paper which are useful for the present purpose - namely to help clarify the meaning of location. I will use the definitions of Michel de Certeau, a French cultural theorist (1925 - 1986), as presented in the 1984 English translation by Steven Rendall² [5]. To summarize, Certeau defines "space as the practiced place" ([5], p. 117). This means that place is defined as "the order (of whatever kind) in accord with which elements are distributed in relationship of coexistence. It thus excludes the possibility of two things being in the same location." ([5], p. 117) Further, space is defined as something which exists when "vectors of direction, velocities and time variables" ([5], p. 177) are taken into consideration. "Space occurs as the effect produced by the operations that orient it, situate it, temporalize it and make it function in a polyvalent unity of conflictual programs or contractual proximities." ([5] p. 177). Hence, a physical object is located within the boundary of a place, and if it is capable of acting autonomously, then it is also partaking in the creation of space within the boundary of that place. Location can thus be seen as a relevant position within the physical conditions of place, influenced by the dynamic situation of space.

For now I will leave the discussion of space and concentrate on exploring place and the physical aspects thereof. The two, however, cannot be completely separated and there will be examples where physical surroundings directly affect movements and thus space.

3 A Study of Architectural Conceptions of Place

Architecture is a discipline, which consciously designs places. Even though architecture is rarely considered a research discipline, and few attempts to put forward architectural theories have been made [10], it is not to be confused with a lack of reflection and ongoing experience accumulation. Thus to study an architectural understanding of the elements of place bode to be a rewarding effort in contributing to the elaboration of what location entail.

The strongest explanation of architecture is architecture itself, through buildings, city plans etc. However, the relationship between the built and the experience of the built is often implicit, and thus not available to a non-architectural scholar like myself. In order to understand place from an architectural point of view, I have therefore chosen to study architects' considerations of the experience of place when they design buildings.

3.1 Method

The study consists of a preliminary text analysis of project descriptions intended for competitions, followed by four semi-structured qualitative-interviews.

² In de Certeau's definition (or in the translation) space and place are used different than what the majority of space/place theorists have done in that some of the characteristics he ascribe to place others ascribe to space and vice versa [6].

The methodical approach is inspired by phenomenological analysis, in which the objective of the interview is to achieve insight into the interviewee's life-world [13]. In this case, the life-world refers to the architect's perception of the correlation between place and the perception of place within her professional work. The method dictates an unprejudiced approach; however, with reference to hermeneutics, this is not possible in practice [13]. Hence I have chosen to account for my prejudice beforehand in the form of the preliminary text analysis which I used for the interviews and the conceptual background presented above.

The text analysis, conducted before the interviews, was based on project descriptions of the kind used for competitions. All descriptions came from the reputable Danish architectural studio Vandkunsten [16]. The choice of studio was the result of a search for an enlightened sense of quality. This particular studio is well known for its ability to articulate reflections on the relationship between the experience and the built [16]. On the basis of four of their recent winning project descriptions, I identified what seemed to be the key aspects of the architects' considerations. The result of the text analysis served primarily as a basis for the interview.

Four semi-structured interviews were conducted, each based on one or more concrete projects in which the interviewee had played an important role. Each interview lasted about an hour. The architects had been practicing architecture between four and 55 years, and had participated in between 20 to 150 projects. All four architects were from Vandkunsten. The interviewees were chosen in collaboration with a contact person, who pointed out some of the more articulate of his colleagues. The number of interviews was not decided beforehand, but I continued for as long as significant new material emerged. The three main questions for the interview were: 1. How the interviewee approached the project in question, i.e. the procedure for creating rooms, 2. What considerations the interviewee had made vis-à-vis creating rooms during the project, and 3. What the interviewee understood by those key aspects identified in the text analysis, which had not yet been addressed in the first two questions. The interviews were recorded and transcribed for further analysis. Through three iterations, the material was distilled and formulated to an insight into the correlation between experience and the built.

As with any empirical study, it is necessary to establish its limitations. The single most important factor in this case is the generalizability of the material. As the interview subjects came from just one architectural studio, it can be argued that they were likely to have one specific view on 'experiencing place,' and that architects from other studios would have had different answers. I will not deny that this may be the case; however, their answers were all rather ordinary, in the sense that they would be easily recognizable to anyone who has been in a building or city. Moreover, their understanding, according to themselves, did not come from architectural theories, but from their own lived experience. I am convinced that none of the results below would be disqualified if architects from other practices had been interviewed. They might, however, weigh the elements differently, just as they might contribute a different set. Furthermore did all four

interviewees focus on different aspects of experiencing place, however, they still at least mentioned all of the aspects presented in this framework. This leaves this study as a preliminary attempt to develop an understanding of place based on the architectural domain.

3.2 Architecture

The text analysis revealed, and the interviews confirmed, that architects juggle a large body of elements and concerns such as function, esthetics, landscape, climate, infrastructure, social dimensions, future maintenance, construction planning, and economy. Describing architecture, one of the interviewees used the analogy of music. Architects, he maintained, "organize objects and create order, but at the same time induce to make the order musical by inserting breaks into it."³ Another stressed that, "to build is brutal, it's a monumental art-form," which creates the necessity to "give something back, it's a thanks-giving." Thus architecture is a discipline striving to create qualities. It aims to analyze the given boundaries of a project and "find out how to bring out qualities within those." The concept of quality refers to the experience of the built covering both the indoor experience and how the built relates to the context in which it exists.

Architecture inside a building is about the rooms and their atmosphere, the flow between them as well as how they support different purposes. A good room is considered one which is "distinct, has character, and orientation." This is obtained, among other ways, through the architects' "sense of materiality, character and materials."

Architecture is also about creating transitions between the built and the landscape as well as between the individual and society. To build in a context. "A house on the heath is different from one on the moraine hill, in the forest, or on the beach." The relation to the context is, however, not necessarily a question of blending in, "the built can be distinct," rather it is about making the transition harmonious. As for the social context "no architecture can save a drug-addict, but it can create social possibilities." For example to "create a large window looking into the kitchen and make sure the pathway goes right by" gives a possibility for neighbors to keep an eye out for each other. Or to create semi-public rooms such as courtyards or community facilities, providing a gradual transition between private and public.

Thus, architects design places with space in mind. They design for future use and even if they have no direct control they are able to use a variety of measures to guide how people live and operate within the places they create. The next section elaborates on these measures. The argument is that they are the exact same which actually influence human experience of a place and therefore relevant taking into account in the design of location-based applications that hold implications for human behavior.

³ All quotes from the interviews are translated from Danish by the author.

4 A Framework of Place

To recapitulate, the concept of place refers to the physical order of objects; it is the physical boundaries within which we act. This framework is an account of what such boundaries contain (and their potential attributes). It is developed on the basis of what place comprises of according to the presented study architecture. The framework is not a pattern language as Christopher Alexander's [1], which is concerned with specific shapes and forms, rather it is about the experience of the built and its contextual relations.

The interviews revealed how a place can have a variety of properties contributing to its atmosphere, the sensed experience of being present at the place, as well properties which more directly shapes the activities to take place. It is not possible to make a sharp distinction between the atmosphere and the activities a place supports, however, some aspects affect the way of being more than the way of operating in a place.

4.1 Atmosphere

"Light creates the room. If you don't have light you don't have a room – that's rather banal. If the light comes equally from both sides the shadows disappear, which creates confusion."

"Northern light is cold and possible to absorb in large doses, it is often used in ateliers or otherwise if you want non-disturbing shadows or call it objectivity. Southern light is the sun, which is the type most ordinary people strive for and what is often used in residential housing." The two types have different degrees of warmth and coldness and architects use them to create balances and nuances through various degrees of blinding. Further, they use materials and colors to buttress or moderate the light. "To underpin a northern light you would paint the room cold e.g. a cold blue. For neutrality you would use white. If you choose the sunlight you would use yellow or brown to emphasize the sun. But for a less intrusive approach, you would perhaps only paint the window-frame and keep the rest white. This would ensure that when the light reaches the room and is reflected on the walls it has brought with it some of the color from the window-frames."

"The sensation of a room is primarily shaped by its light, materials and color and of course its proportion."

The proportions of a room are important for the human body. A room with a low ceiling can create a sense of intimacy, while large rooms can make one feel utterly small. A room in a residential house will normally measure between 2.50 and 3 m in height. "By letting a room measure 4.80 in one side and 3.60 in the other side, you create a high-ceilinged room with character." The proportion of a place is also a factor when establishing a sense of which activities it is suited for – e.g. soccer matches are unlikely to take place in two-by-three meter rooms. The proportions also indicate the level of privacy, with private places tending to be smaller than public places - especially in urban settings.



Fig. 1. A place outside defined by the surrounding buildings, with treetops sketching the roof and filtering the sunlight. It is a place outside yet it is not completely out in the open due to the trees and the buildings. (Illustration by Olmo Ahlmann)

Closely related to proportions are concerns of shapes and vertical position, which contribute to the creation of character and thus atmosphere.

Furthermore the interviews, but especially the text-analysis, revealed temperature and sound as additional factors, which influence atmosphere. Temperature affects whether or not the body finds pleasure in being in a certain place. It is influenced by the degree of shelter from the wind and shadowing from the sun and of course the presence of artificial compensators. Likewise, sounds have a direct impact on the atmosphere of a place depending on both the type and the volume. An extremely noisy place reduces the amount of time a person will spend in a place and what actions can actually take place there. However, not all loud noises are equally uncomfortable. Those attending a rock concert, for instance, most often wish to experience loud music.

Table 1. Summary of Atmosphere Shaping Attributes

Type	Examples
Light	northern, southern, artificial or strong/weak or direct/indirect
Color	cold/warm or strong/pale or red, yellow, blue
Materials	concrete, tree, glass, stone, clay, tile or rough/soft
Proportions	human scale or large industry building
Shape	circular, square, blurred
Vertical position	floor or altitude
Temperature	Celsius or Fahrenheit
Air/wind	clean air or wind speed
Sound	machine, animal, human or high/low

4.2 Activities

A place may have an embedded functionality, which is likely to influence the activities taking place there. "Cooking is a central activity in a home. Thus, by placing the kitchen in the central room of the house there is compliance between the intention of the room and its functionality." Other places have less predetermined functionality, but are through their accessibility (or lack thereof) more suitable for some activities than others. "It often turns out to be practical to have a separate bedroom." Here, 'separate' indicates the possibility of isolating the room both visually and audibly from others than those who seek privacy. Another type of activity shaping accessibility is the presence of resources such as water, power, WiFi etc. Even if these are often related to build-in functionality they need not be.

Table 2. Summary of Activity Shaping Attributes

Type	Examples
Entrances	bodily, visual, audible or mediated/direct or easy/difficult
Functionality	bathroom, kitchen, playground
Resources	power, water, gas, WiFi

A place, however, is never totally detached from its surroundings. Thus, neither is the atmosphere nor the activities carried out there. Architects talk about respecting *genius loci*, the spirit of the place, the context within which they build. This is done through choice of materials, colors and so on, but even more importantly is it done by creating a variety of hierarchies and infrastructures through which the place is related to its surroundings. Hierarchies and infrastructures can therefore be considered important aspects of how a place relates to its context.

4.3 Hierarchies

"Hierarchies as used in architecture is not a question of power structures – it is about spatial⁴ hierarchies and about enabling belonging" The architects operate foremost with three types of hierarchical scales: proportional, social and indoor/outdoor. They all intertwine and exist simultaneously, but will be treated separately below.

"Working with spatial hierarchies is a method to bridge the relation between the individual and the society. This is the home, this is a semipublic place and this is public. You take your privacy with you further and further into those places where you become more and more of an anonymous citizen the further

⁴ To architects 'spatial' or 'space' takes on a different meaning than de Certeau's, they conceive it more as the volume of a place. Therefore, to avoid confusion, the architects' definitions are used throughout this section.

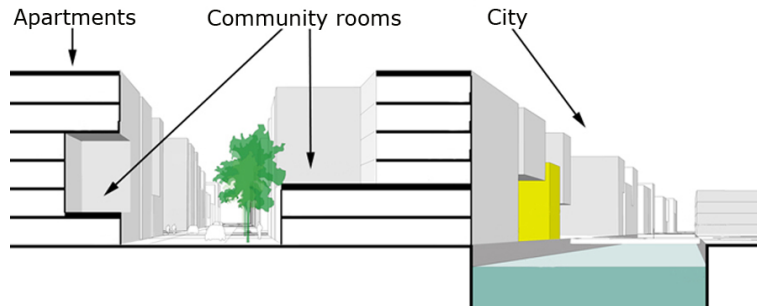


Fig. 2. The figure illustrates a spatial hierarchy where the scale and the private/public relationship gradual changes from the apartment, to the common terrace to the rest of the city. (Illustration by Olmo Ahlmann)

you go.” This is a hierarchy with a social scale. A kind of hierarchy seemingly comprising only of cultural conventions, however, the social is interpreted into the spatial structure in such a way that transitions between the different stages of privacy are demarcated, either materially/physically, or semantically. And it is precisely this correlation which plays an important role in enabling people to orient and navigate and behave appropriately vis-à-vis other people.

Furthermore, a spatial hierarchy is relevant with reference to the size of the human body. ”A gradual transition between large, indistinct places and small, intimate places illustrates to people where they are heading. It helps them orient and navigate the physical environment.” A proportional hierarchy with clear transitions can help ”getting the body transported into the house.”

A third type of hierarchy, which has characteristics similar to the other spatial hierarchies, is the transition between the indoor or the outdoor. This transition can be more or less gradual and as such create different expressions and support different activities. Both the proportional and the indoor/outdoor hierarchies are part of the measures, which may guide navigation in the physical surroundings as well as navigation in the social hierarchy.

Table 3. A Summary of Hierarchies

Scale	Examples	Enables
Social	home – community garden – town-hall square	social navigation
Proportion	house – apartment building – industrial area	physical/social navigation
Indoor/Outdoor	bed room – balcony – plaza	physical/social navigation

4.4 Infrastructures

The second component, which plays an important role in relating a place to its context, is infrastructure. An infrastructure is a structure of connections between different places. An infrastructure may have a variety of attributes and characteristics, which influence the experience of being and operating in a place that it connects. To analyze the attributes of infrastructures in more detail, an initial distinction can be made between the physical infrastructure which supports movement of the human body as well as audible and visual connections, and the physical infrastructure which supports distribution of resources such as power, water etc. – a distinction between infrastructures for human use and infrastructures solely for resources.



Fig. 3. This map shows 500*500 m section of Venice. The dark grey (red) areas are the system of roads and plazas which supports various kinds of movement on land. The light grey (blue) are the canals which supports transportation by boat – primarily the gondola. Together they constitute the city's infrastructure. (Illustration by Olmo Ahlmann)

The physical infrastructures within which humans can move around have several purposes. First and foremost it enables people to get from one place to another and as such it is an obvious way of relating a place to its context. Its layout, its number of connections, and the modalities of transport it supports determine how easy it is to get to a place just as how easy it is to get away. To architects this is an important tool to guide people to go where the architects plan to. "You need to go up those stairs right where I placed it, and you need to go through that door – there is no other way. This means that some infras-

structures allow for the architect to guide people's movements very precisely." People are confined to move within the physical infrastructures. Infrastructures can support different means of transportation which is reflected in the formation of the structure. In residential buildings the architects need not only to consider if "there is access for firefighters and ambulances, but also if Mr and Mrs Smith with their shopping bags and little Peter are able to enter the house – a car may be one way to arrive at the house, but we prefer to give advantage to the pedestrians."

Secondly, infrastructures hold some of the same characteristics as hierarchies. "A well functioning infrastructure can give such a banal clarity and a good understanding of how you are supposed to move about in it and where you belong." Where well functioning refers to the layout of the structure, the ease with which it is read. Or as one interviewee expressed it "an infrastructure needs to be so clear that it can be pissed in snow – by a woman."

A third purpose, or effect, is its social dimension. As it guides people's movements it is destined to influence social behavior. "You arrive at your residence from inside a garden that is common for all of these residential units, but only to nine units, which means that you know everyone here. This could be an enormous comfort to families with children, and it's what you might call natural surveillance."

Beyond bodily movement infrastructures may support visual and audible connections between places. Such infrastructures often coincide with those enabling bodily transport, but they do not necessarily do so. Windows and glass-walls enable outlook and insight and thus partake in connecting the place to its context. Thus, these connections provide clues as to where in the broader context the viewer is, as well as they affect the social activities carried out at that place. In a residential housing project the architects built "an inner street with open staircases which everyone is forced to use. You cannot avoid seeing each other – there are no escapes. The street is narrow, it is the width you know from the streets in the old part of Copenhagen, where it is possible to talk to each other across it. And there are large windows facing the street – very large, people cannot hide from each other."

The second type of physical infrastructure is the one enabling distribution of resources or "the nerve fibers of the welfare society" as one interviewee phrased it. These infrastructures are seldom interesting for people as such. People only need to know if resources, such as water, electricity, telephone lines etc., are available at a place or not, and perhaps the strength with which they can be accessed. The infrastructures are, however, interesting for maintenance and related purposes.

4.5 What the Framework is and What it is Not

This framework is an analysis of what architects consider to be fundamental aspects of a place. It builds on the considerations they make when constructing places, and it assumes those aspects to be the same that generally influence people when being and operating in a place. As such, it can be considered a useful source of information in the design of location-models that seek to encompass

Table 4. Summary of Infrastructures

Type	Modalities	Measures	Enables
Bodily	foot, car etc.	meters, miles	movement, overview, social interactions
Visual	direct, mediated	clarity	visual contact, overview, social interactions
Audible	direct, mediated	decibel	audible contact, social interactions
Material	water, power etc.	liters, voltage	various activities

human relations vis-à-vis location. It is, however, not an ontology as there exists several aspects unaccounted for. First of all, this framework is only concerned with place, or rather the physical order of aspects of location, it is not concerned with space, or the operations which orient it, situate it, temporalize it. Even the aspects of place are not necessarily fully covered through the study of the architectural domain. Domains such as environmental psychology, cultural geography, and anthropology are also likely to contribute with valuable knowledge about characteristics and attributes of place.

This framework is a first step towards establishing a more nuanced notion of location and thus a step towards more suitable location-based applications. It demonstrates the potential gains from consulting other domains to establish better relations between the digital and the analogue parts of the world. We need not go out and study everything on our own, in order to design useful digital artifacts, we can draw on existing knowledge from other domains.

The next section elaborates on the utility of a framework like this and demonstrates it through conceptual designs of two location-based applications both of which builds directly on the knowledge it presents.

5 The Framework as a Design Tool

A framework like the one presented here can be used as a source of knowledge to gain insights into a specific domain – in this case the aspects of place which may influence human way of being and operating at a place. Thus it forms a basis upon which models can be built. A location-model for a location-based application builds on two sources of information: one is information framed by the purpose of the application, the systematism which signifies the use situation as well as information which influence the perception of the situation; the other is what is generally known about location, that is, a framework of location.

As a demonstration of the utility of the presented framework, it is used in the conceptual design of location-models for two location-based applications, which are presented below. The framework covers only place and not location. As a whole, the conceptual designs are therefore limited to ones that are place-based and not space-based.

5.1 Lovers' Sense of Each Others Place

Imagine a couple deeply in love wanting to be able to sense where the other part is when they are apart. Perhaps they are living in separate cities, or one of them travels frequently. A well-designed location-based application could provide a sense of the lover's place. Such an application touches upon the delicate matter of surveillance which is why it needs to be based on mutual agreement and perhaps even leave room for the users to lie a little. However, an objective of the application design is to make the information as abstract as possible, while still enabling users to sense the atmosphere at their lover's location.

The application is designed for a mobile phone or similar device, which is imagined to be equipped with different kinds of positioning technologies, for both outdoor and indoor use. Thus, it always knows its own position. When one party in the relationship activates the application, it will send a request to a server, which then queries the other's mobile phone to obtain her position and other available pieces of information about the atmosphere at this position. With the position-information the server consults a location-model, which has access to even more location-information in a server side database. It collects all information that may contribute to a sense of the atmosphere at the lover's location and sends it back to the application on the first mobile phone.

The design of the location-model for the application should be based on the purpose of the application, and on the characteristics of location that, according to the framework, are relevant for that purpose. The purpose in this case is to communicate a sense of the atmosphere at a distant location through a small and simple screen. The framework provides a list of atmosphere shaping attributes, which would be an obvious starting point, but even knowledge of the context seems to have an essential influence on the atmosphere. The real challenge, however, is to represent this information in way, which actually communicates the sense of atmosphere. According to the framework the four most important factors were the light, color, material, and the proportion of the place. These should thus be the foundation of the representation. The overall measure of light could be represented as brightness of the picture. The colors present could be represented as a patchwork with the size a patch being correlated with the relative domination in the environment. The material could be represented as structure in each patch. And the overall proportion of the place could be represented by the size of a thin black frame drawn on top of the patchwork. Further information could be applied in similar ways until the picture no longer were sufficiently clear. As for the contextual information it could be provided through an ability see the history of atmospheres and thus the surrounding from which the person arrived.

Not all of this information can easily be obtained. Some pieces of information could be collected from sensors built into the mobile phone, while others could be compiled from available CAD (Computer Aided Drawings) files and GIS (Geo Information Systems) databases. Yet more information could be user-collected, for instance, by letting every user take part in the gradual development of the server's database.

5.2 Navigation in a Hospital

The next conceptual design is about navigation in a hospital. During the course of treatment, outpatients and some long-term patients are likely to be asked to go to different wards on their own. If the hospital is of a certain size or spread over a large area, it may be rather difficult for patients to find their way around. In this case, a mobile location-based guide could be useful. The tasks such an application should perform would include:

- Finding the shortest route from A to B which suits the patient’s mobility, and ensure that she would not pass by inappropriate wards on her way.
- Providing route descriptions to enable easy coupling between the directions given and the surrounding environment.

The application is designed to run on a small, handheld computer, such as a mobile phone, which is equipped to communicate with the positioning system implemented at the hospital, e.g. through a distribution of servers and several RFID (Radio Frequency Identification) tags and/or Bluetooth checkpoints. The user is able to download the application upon arrival at the hospital, or in advance through the hospital’s website. Design for such small computers should take into account limited screen properties, small amount of storage and processor capacity. It may therefore be necessary to delegate some processing but especially storage tasks to fixed servers around the hospital.

The model needed to solve the first task should build on knowledge of the type of situation: to find a path from A to B. For this we consult the framework and find that infrastructures, which support bodily movement, are often specialized for different types of modalities, which again is correlated with the ease with which distance is covered. Thus the model should build on information about the modalities and distances in the present infrastructures. Furthermore, the diagnosis should be part of the information basis of the model as it may influence the user’s mobility as well as apply constraints to which places would be inappropriate to pass by. For example, a woman who has experienced a miscarriage should not be led through the maternity ward. In summary, the model needs four types of information to solve the task: 1. Every possible route from A to B, 2. The distance between A and B in every route, 3. The modalities by which the route can be covered correlated with the user’s potential mobility constraints, and 4. Which wards are passed en route from A to B correlated with any constraints from the diagnosis. Given A and B, the model is able to find the shortest suitable route. In case of ambiguity, either the patient is asked to choose or the system can make a random choice.

The model needed to safely guide the patient from A to B again draws upon the framework as it is necessary to find the type of information people rely on when navigating in a physical environment. This information is needed in order to make it possible for the user to link the navigation information with actual environment. The framework inform that navigation is supported by hierarchies of proportion and indoor/outdoor, the ability to gain an overview of the plan-arrangement i.e. the infrastructure for bodily movement, as well as variations in material, form, colors etc.

The hierarchies are relatively simple to represent through descriptions of the sequence of rooms the patient needs to pass through. For example a small room indoor followed by a hall with double height which is followed by an outdoor road. The overview of the plan-arrangement could be provided through a presentation of the actual drawing of the plan-arrangement. However, a constructed plan-arrangement usually differs from a drawing in that it is difficult to make the connection. A solution could be to combine the drawing of the plan arrangement with some elements that make it easily linkable with the surrounding environment. By presenting eye-catching variations, such as change in color or material, on critical places in a building, such as turns, crossings and different floors, it would be easier for the user to make the necessary link. This could be done through photographs in combination with a drawing of the plan-arrangement. Thus, the application could guide the patient by means of a textual route description, in combination with relevant sections of an enhanced drawing of the plan-arrangement.

Because photographs and drawings can be bulky to download on a small computer, they might be transferred to the computer from servers placed throughout the hospital as the patient moves around. Such servers could also serve as checkpoints to find out if the patient is on the right track.

6 Concluding Remarks

A first step is made towards establishing a framework on location which can inform design of location-based applications. A framework of place is presented and rendered useful in aiding design of location-models for some location-based applications. It provides a set of elements, which should be considered and evaluated as part of the design process on equal terms with knowledge of the specific purpose of the application.

Environmental psychology, cultural geography, anthropology, sociology and social psychology has been suggested as other domains which could contribute to the continuation of establishing a framework of location. The major point being that it is necessary to draw on knowledge from other domains in order to gain a more comprehensive understanding of the complexities of humans vis-à-vis location.

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