# Information Visualization of Environment Maps for Complex, Relational Data for Better Reflected Decision Making on the Example of Food

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**Abstract**

My dissertation aims at developing an application that presents all the information a user needs to find orientation in his environment. All surrounding places and their characteristics shall be perceived and compared in a fast way. The goal is to implement an overview map application to reduce information complexity of one's spatial location by using appropriate interaction and visualization methods.

**Keywords:** user interfaces; visualization, food environment maps

## 1 Introduction

Due to a growing amount of data and the problems related to this trend (Lange, 2009), there is a need for user centered information visualization software (Macaulay et al., 2009), optimized for target group needs – software that enables a better handling of large amount of information (Gantz, 2008). One big challenge by working with webGIS, in regard to location based applications (LBAs), is the complexity of data (Longley, 2011) and to present

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them in an overview in order to enable users to rapidly and cognitively process the information (Xu et al., 2011).

### 1.1 Food environment as an example

Health research shows that for individual nutrition behavior environment and circumstances act as influential forces (Loss & Leitzmann, 2011). This aspect leads to the idea of gathering information about explicit indicators of a food related point of interest (PoI).

### 1.2 Visualization of complex data for food environment maps

A food environment application with multi parametrical data has to be based on an interactive information system reliably presenting the density of information, through fast and simple navigation (cf. Mazza, 2009: 105–124), overview, filtering and detail information views (Shneiderman, 2003).

### 1.3 Objectives

The task is to develop an application which enables users to more easily classify and recognize their surroundings according to personal assumptions. Therefore the user shall be able to perceive all relevant information about surrounding PoIs and its nutrition related aspects fast and intuitionally. The aim is to find out how concepts of interaction and visualization for overview map applications can reduce the complexity of the information contained in one's surrounding.

## 2 Materials and Methods

To examine how to prepare data best for interactive environment maps applications, during the concept stage elaborating descriptive/explorative prestudies will be executed. These results, in addition to a short review of the further developments of the reference model of information visualization, shall lead to the development of a new model. By agile software development in dependence on the DIN EN ISO 9241-210 (2010) I create an alpha

release of the food environment map. The following step is to measure an improved beta release by asynchronous remote usability test in combination with A/B tests.

# 3 Previous Results

## 3.1 Model formation and und concept

The analysis of the achievements of the reference model of information visualization shows by starting from Salton and McGill and their concept of "iterations during information retrieval" (cf. 1983: 237) looking from Ellis, Cox and Hall describing the "process model" (cf. 1993: 356–356) to for example Belkin's "model of episodes" (cf. 1996: 25–31) along to the "cognitively extended model for information retrieval" of Landwich from 2007 (fig. 1) that the user itself gains an increasingly prominent role during the modeling. Thus, one arrives at following hypothesis: By modeling information retrieval, there is a tendency to focus more closely on the involvement of the user and its cognitive ability to process information as a part of the retrieval procedure.

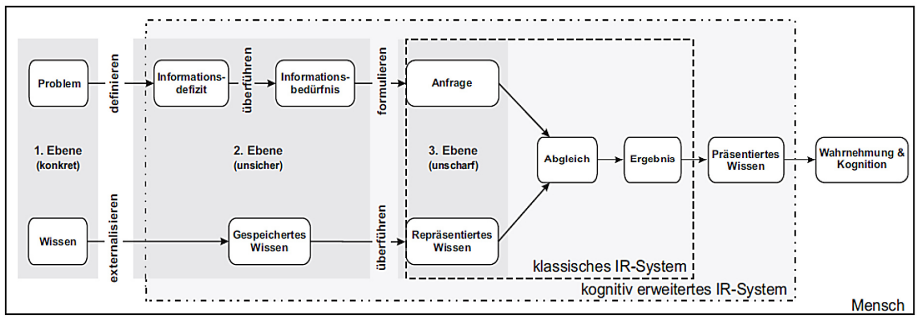


*Fig. 1* Cognitively extended model for information retrieval
(Landwich, Hemmje & Fuhr, 2007: 328)

Based on this hypothesis, a model has been created that maximizes the match between the user's needs and the characteristics of one unit of retrieval (UoR). The intention is to create an application which makes it possible to present multi parametrical, relational data in a specific context by achieving a

fast and comprehensible success in searching, assessing and preferencing the data. A major thought at this juncture is to focus the role of the user and its ability to interpret and intuitionally perceive the information and therefore influence the selection and emphasis of it (fig. 2).

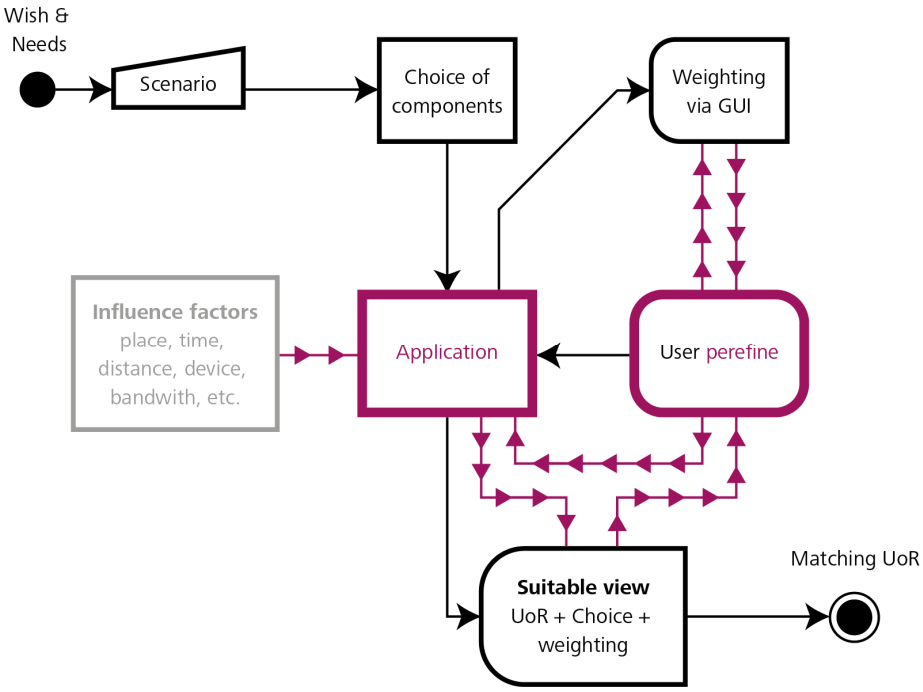


*Fig. 2* Model of processes

This continuous user interaction is called “perefine”. As an acronym for the coalition of the processes of [congnitional user] per[ception], ref[lection] [and] in[t]e[raction].

As a consequence, the idea of an interaction and visualization model evolves, that iterates from a user centered perspective over following steps:

1. A user need is abstracted as
2. A scenario, which leads to a
3. Selection of criteria and components.
4. That will be assessed.
5. Out of which a visual structure will be created and
6. Presented in a view.
7. All the results will be reflected.

These steps are put in order in a rotation loop to demonstrate how closely all these elements are connected to the user's cognitive perception and ability to reflect.

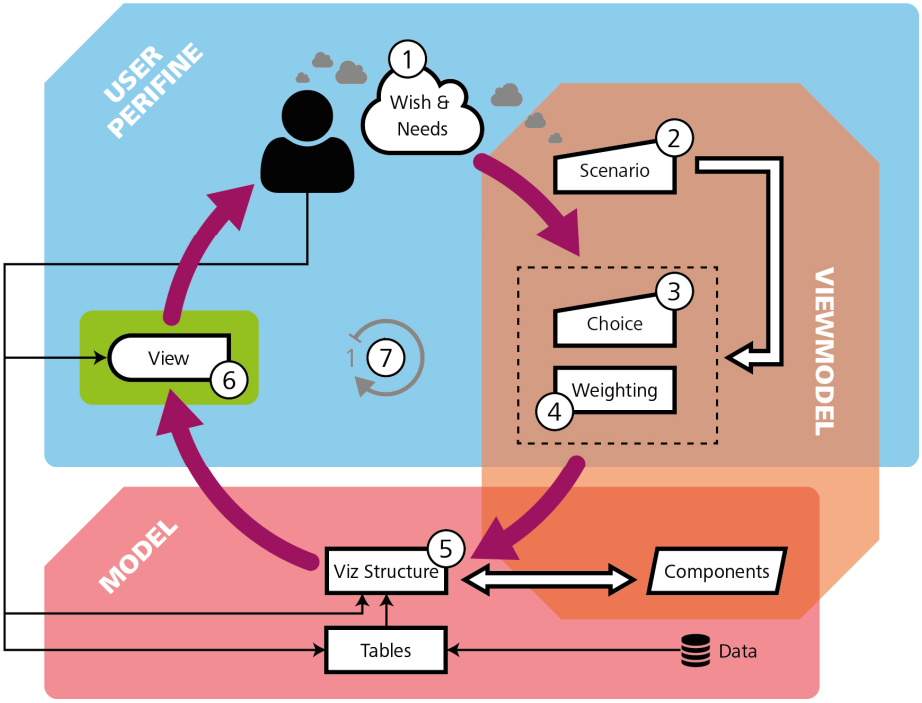


*Fig. 3* Concept model of interaction and visualization – as projection on MVVM (cf. Kühnel, 2013: 1091–1096)

## 3.2 Prototypes

A prototype like alpha implementation (Stephan, 2016b) with crawled data from the Google maps API (Google Developers, 2016) combined with randomized data per UoR provided different visualization methods in order to prove the feasibility of each. These examinations pointed out that problems can occur with the dataset which lead to bias. Incidentally, I tried to improve the application adding different measuring scales and replacing the data by parts of the "Yelp Dataset Challenge" dataset (Yelp, 2016). In this way it was possible to create more mock-ups (Stephan, 2016a) and simultaneously, the beta release development has been pushed.

## 4 Research challenges and outlook

Finally I will evaluate the beta release prototype by asynchronous remote usability tests. The plan is to compare the application in an A/B test against a standard tag-based application and measure the usability by using the meCUE (Minge & Thüring, 2009) questionnaire. It is to clarify here which requirements the tag based applications needs to fulfil to minimize bias. Furthermore, the recruitment of a sufficiently large test group poses a challenge. Generally the requirement to guarantee the identification of major key facts for evaluation has to comply.

In consideration of good usability of the model more use cases shall be illustrated. Through transforming it into other context areas like i.e. noise and silence, working conditions or education the adaptability to meet the different needs shall be proved. It would be the aim to assist the reflections and comparisons of users with utilizable systems for complex decision criteria.

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