Sensemaking in the Space: An Alternative Design Perspective for Mobile Navigation Systems

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ABSTRACT
In this paper, we present the essential idea of an on-going project studying navigation in physical environment as sensemaking process. Initial design guidelines are proposed for discussion.

Categories and Subject Descriptors
H.5.2 [Information Interfaces and Presentation (e.g., HCI)]: User Interfaces – Evaluation/methodology, Prototyping.

General Terms
Theory, Design

Keywords
Navigation, sensemaking, mobile interface design

1. Poster Abstract

Navigation in physical environments is a basic human survival skill. We study maps before set outing and connect 3D real world objects with 2D abstract icons on maps during the navigation by continuously checking and consciously memorizing. Complex modern architectures and city plans plus increasing travel span challenge our navigation ability. If finding our way is solving a spatial problem as Passini suggested more than 30 years ago [1] and has been believed ever since, nowadays, this problem becomes more and more difficult.

Proliferation of GPS units simplifies navigation in unfamiliar places as following step-by-step direction. We no longer need to go through the whole process of spatial information gathering, decision making, and decision executing as problem-solving. The active explorer is degenerated into a passive follower. Problem coming with such cognitive easiness is the “mindless of the environment”[2]. In case GPS devices are out of access, malfunction, or simply give wrong directions, people may not be well prepared to react to unexpected environmental conditions and find alternative action plans. Empirical study suggested that with the slavery of automatic tools could results in degeneration in acquisition of spatial knowledge [2].

While most current studies on navigation come from the perspective of goal-reaching, but the contribution of navigation to spatial knowledge learning is under-investigated. The process can enhance learning and knowledge gaining even the problem is not solved, or not quickly solve. Sensemaking, a concept first proposed in 1980s [3], was reproposed and has become a serious study field [4-7] triggered by information explosion: we need to find meaning of the world regardless the increasing data volume. Several models are proposed to capture sensemaking process in both individual level and organizational level[e.g. 4, 5]. Though vary in details, most of these models agree that sensemaking is an iteratively engaging process that tries to bridge the gap between observed information with structured concepts (e.g. encoding data with schema, instantiating structure) in order to form a coherent understanding. In such iterations, computational tools that provide proper external representations are believed to facilitate individual sensemaking process by reducing transaction memory, influencing the level of participation, providing manageable artifacts, and helping pattern recognition, which is highly desired at current stage[8, 9].

We propose another perspective of physical navigation as a sensemaking process. Despite physical navigation is a direct metaphor for making sense out of massive information, fewer researchers approach navigation from this perspective except: Kevin Lynch [10] introduced a viewpoint to how inhabitants interpret environment with his pioneering work on imageability, which characterizes the way people create mental pictures consisting spatial primitives (paths, edges, districts, nodes, and landmarks); Klein argued that the lost and recovery stage in navigation could be treated as sensemaking processes based on his semi-formal interview [11]. Moreover, no practical design supports navigation as to support spatial sensemaking, considering the scarce existing tools support sensemaking in general.

Viewing navigation as a legitimated sensemaking in scenarios where cognitive agents need to know the environment instead of a one-time visit, we are investigating the design implications for mobile guides. Particularly, how to support sensemaking during navigation by visual representations with the limited display estate and cognitive attention during moving? What kind of information, in what way to present? “How much is too much?” When comes to artifact design as mobile navigation guide, the problem is how to balance cognitive cost with spatial awareness of the physical environment [e.g. 2, 12].
Based on previous work in both sensemaking and physical navigation, we present a sensemaking framework and the analysis of navigation as spatial sensemaking process with respect to spatial information and clue collection, options and choices comparison at decision making points, fragmented and cognitive maps formation. These processes are similar to the iterative process of fit data into frame and forming frame from data loop in sensemaking. In physical navigation, people comprehend and structure their experiences into imaginative mental representations as they moving and interacting with the environment. In order to effectively identify relevant cues in the environment, navigators collect and filter massive spatial information based on objects’ saliency, either perceptively or cognitively, which reflects the visual prominence or recognized importance for forming mental representation. These salient objects, as anchors, work along with paths connecting relevant places to form fragmented representations. Integrating these fragmentations into a coherent cognitive map by identifying joint points and correct orientation is difficult process. Once the imagery (or image schemata[13]) is formed, such recurring mental patterns could help people learn the space and make qualitative judgment and essential reasoning.

Finally, the following design implications are proposed for interface design on mobile navigation systems.

+ Visualizing landmarks
  o Provide perceptive and cognitive salient objects as anchor points to pin mental structure.
  o Provide salient entities (e.g., important landmarks) to connect the anchor points in different scales.

+ Visualizing routes
  o Provide generalized route maps which emphasizes on segmentation and branches, rather than distance.
  o Provide aspect route maps for different purposes
  o Provide feedback after decision made at decision point for confirmation or instant reorientation.

+ Visualizing surrounding context
  o Provide a topological relationship view that preserve environmental patterns (e.g., the spatial relationship among cognitively salient entities and routes) to help construct the frames of mental image.
  o Provide different “level of detail” maps results in mental models with different completeness to response to different task requirements.
  o Provide content-context visualization to support connecting fragmentation into complete mental image. (coordination transformation)

2. REFERENCES