Comment to Taxonomy of Wayfinding Tasks by Wiener, Büchner, and Hölscher

Andrew U. Frank
Gusshausstrasse 27-29/E127,1
A-1040 Vienna, Austria
Technical University Vienna
frank@geoinfo.tuwien.ac.at

Abstract: The effort to clarify the terminology to describe wayfinding was overdue and I applaud Wiener, Büchner, and Hölscher for their contribution [ref to previous article]. A clear terminology is important for reporting and discussing wayfinding research, but it is probably important for the design, planning, and analyzing of experiments as well, which suggest a Whorfian like hypothesis in science!

I have three comments regarding their taxonomy:

1. They advertise a taxonomy, but their important contribution is in the identification of properties they use to distinguish the taxa.
2. Their definitions may lead to misunderstandings; replacing the verbal descriptions by formal definitions using a computational model avoids ambiguities.
3. They classify the wayfinding task based on the knowledge of the navigator alone; the environment should be included to achieve a more precise comprehensive, with all factors influencing the selection of a strategy.

1. A Taxonomic Lattice for Wayfinding

The contribution by Wiener et al. builds a hierarchical taxonomy by first separating locomotion from wayfinding and then subdividing further. Each level of a taxonomy uses a property where two (or more) contrasting values are distinguished; these will be termed „distinctions“ (Frank 2006). Wiener et al. introduce the following distinctions:

- locomotion vs. wayfinding (following Montello 2005),
- aided vs. unaided wayfinding (presence of wayfinding aid),
- direct vs. undirected wayfinding (presence of specific destination),
- search vs. target approximation (availability of destination knowledge),
- path following vs. path finding (availability of destination knowledge),
- exploration vs. cruising,
- informed vs. uninformed search,
- path search vs. path planning.

Their taxonomy introduces more than a dozen terms for taxa, to which they give novel, more precise meaning; nevertheless the taxonomy leaves some questions open, for example:

> Why are there no distinguished directed wayfinding tasks where the destination is not known and route knowledge available?
>
> How to describe aided distinctly wayfinding with or. without destination knowledge? The same distinctions are made, but new names for the taxa are required.

Availability of survey knowledge is used in combination with other distinctions to construct 6 different taxa, multiplying names for taxa without need, i.e., introducing the terms exploration, cruising, informed and uniformed search, path search, and path planning.

The set of five distinctions Wiener et al. use are:

- locomotion vs. wayfinding,
- aid for wayfinding present,
- destination present,
- destination knowledge,
- survey knowledge.

These 5 distinctions combine to $2^5 = 32$ taxa with a definite value for each distinction. Together with the generalized taxa for which not all values are defined a semi-lattice is formed. It contains all distinguishable and describable taxa. Important is not the taxonomy per se, but the ability to describe precisely each case and to express which cases are generalizations or specializations of others. This is achieved by the set of distinctions Wiener at al. give, respective the semi-lattice constructed from them.

For example, the case of a tourist using a map to explore a city is available automatically in the taxonomic lattice constructed from the distinctions introduced by Wiener et al. It is characterized as “aided, undirected wayfinding” but is not a taxon included in their taxonomy.

2. Formal Definitions of Terms in Computational Models

Wiener at al. consider primarily the navigator's knowledge and classify wayfinding tasks on what knowledge is available. Verbal descriptions of types of knowledge are imprecise and lead to ambiguities. Consider the case where the navigator has survey knowledge of the environment, which does not include the location of the destination. Can it be described with the given distinctions? Wiener at al. would likely classify this as „path search“, *implying* that “survey knowledge available” applies only when the destination location is known.

The knowledge available should be defined more carefully. For example, destination knowledge may mean

- a generic description of the type “I know it, when I see one”, e.g., a nice restaurant, or
- a specific destination like „The Golden Globe“ restaurant.

Independently from the knowledge of the destination is knowledge about the location of the destination and the relation of this knowledge to the type of knowledge of the environment available to the navigator.

The description of types of knowledge is notoriously difficult; a way to avoid misunderstandings is to construct computational models of the navigation process (Frank 2000; Raubal 2001; Raubal 2002). Using appropriate formal languages, such computational agent simulation models can be shorter than a corresponding attempt to describe the same types of knowledge with natural language sentences.

3.Extend the Classification to Include the Situation

Wayfinding strategies depend on the knowledge of the navigator and the same task posed to navigators with different knowledge about the environment may lead to different strategies. But not only the knowledge influences the wayfinding strategy; a navigator in a city will follow a different

strategy than one in a forest environment. There are many strategies navigators follow and the goal of the classification of wayfinding tasks should be to describe tasks sufficiently that the description determines the strategy.

A wayfinding task occurs in a system with several, distinguishable components

- type of goal or “task” in the terminology of Wiener et al.,
- environment in which navigation takes place,
- perceptive abilities of the navigator,
- knowledge of the navigator about his actual position,
- factual knowledge about environment (including navigation aids),
- locational knowledge about the goal,
- strategic, generalized knowledge about navigation in this environment, e.g., probabilities of collocation of objects.

An example demonstrating the influence of the environment on the wayfinding strategy: People, going for a pleasure walk, returning to the starting point in a natural forest environment with no knowledge about the environment and no generalized knowledge will use a strategy to memorize at each decision point the situation and to return on one's steps. In a city environment some general knowledge about the environment is available and one may try to follow a round trip by maintaining a homing vector.

Many strategies use general knowledge about co-location of object and apply a hill climbing approach: If I search for a restaurant in an unknown city, I select at each intersection the street with more businesses, at night easily recognized as 'more lights'. In Swiss mountain regions a public transportation stop can usually be found without knowledge of the environment nor one's own position by a strategy to descend into a large valley using the inverse of a mountain climb strategy; ultimately a major road, a village, and a bus or railway stop is encountered.

Conclusion

A classification of wayfinding tasks is long overdue. The taxonomy is required to design, plan, report, and discuss wayfinding research. Eventually, the classification is precise enough that it identifies the strategy to use.

The taxonomy of Wiener et al. that structures unaided wayfinding tasks is based on 5 distinctions. The same distinctions give a richer and more useful taxonomic semi-lattice than just the hierarchy they show. To obtain more precision in the definition and to achieve a finer differentiation in the types of knowledge, I suggest to construct computational models, which allow formal definitions. Last, but not least, I recommend the inclusion of the environment in which the wayfinding task is performed, e.g., urban or forest, and to consider what general knowledge about the environment the navigator has. The effort of Wiener et al. is a valuable start to an important clarification; more work is hopefully following.

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