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Issues of Subjectivity and Objectivity in Ubiquitous Mapping

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Abstract:

The progress of discussions on the main issues concerning ubiquitous mapping was previously reported by the author (Morita, 2022). While reviewing theoretical cartography and meta-cartography amid a paradigm shift in which digitized maps are used in a networked society, maps should not only be discussed technically, but also socially and cognitively. In addition to these perspectives, a new issue that should be considered is the problem of information generation in the recent network society. It is implicitly assumed that maps are drawn by people with specialized knowledge on some fixed surface in a homogeneous manner, with no bias in spatial or temporal information and with a high degree of comprehensiveness. With the emergence of digital media, which offer flexible modes of expression, this stability is about to be shaken. In digital media, images are variable and can be manipulated according to the will of the user. In addition, the visual sense can acquire meaning dynamically and freely, instantaneously moving back and forth between the whole and parts of it. The latter are accompanied by subjective operations based on intuition or free will. Maps, which used to be self-evidently objective, are now mixed with operations that are subjective. Therefore, how should subjectivity and objectivity be approached in ubiquitous mapping?

Maps are representations of information and knowledge related to space, where the two are expressed by map symbols and characters for annotations. Normally, information and knowledge are first represented by words and numbers as a form of abstraction; further abstraction is then performed by replacing these words and numbers with visual symbols and expressing these through a map. Then, there might be the third abstraction which involves emphasizing the content to be perceived by enclosing it with lines, indicating by arrows, or to simplify the whole and present it as a schematic diagram. In other words, maps are expressed with double or triple abstraction. On the other hand, a map that is visually modelled through symbols will convey a sense of reality because it can be seen directly through the eyes of a viewer. Because map abstraction and modelling are carried out with a purpose, the process is assumed to be objective-rational but involves the subjective selection and integration of symbols.

In addition, ubiquitous mapping is expected to exhibit interactivity in which the motivation to create and use a map is paired with an immediate result. Immediacy is always required along with the digitization and visualization of information. Guidance is provided under various conditions in the navigation system, and when the destination is reached after the adoption of various choices, the message "Arrived!" is shown. This guidance ends without it having been checked if the best route was followed. Indeed, although subjectively satisfactory, no objective validities are pursued.

On the other hand, the motivation for referencing a map is to acquire knowledge, satisfy curiosity, or deepen awareness regarding a certain phenomenon, in addition to providing support for navigation. Maps are created and used to communicate information and knowledge related to space. It is therefore essential to 1) clarify what one wants to convey through a thematic map; 2) provide a coordinate system to ensure the consistency and homogeneity of the map over time and space; 3) assign an appropriate spatio-temporal scale to make it easier to observe the map as a whole and in parts; and 4) appropriately convert information and knowledge into map symbols and provide attribute information in text or through voice, as necessary. Because such a process is systematized and followed appropriately through cartography, it will be trusted and accepted as objective information.

However, in recent years, in addition to the methods of data acquisition based on surveying and questionnaires, various datasets such as automatic acquisition data using sensors and big data obtained by aggregating information flows on networks have been combined with location information to produce maps. The latter form part of a general pursuit of automation, and numerous images will be generated without significance. The images do not know what to claim as a map. A map with a theme represents the relationship created by a set of symbols, and the meaning of this relationship must be expressed so that it can be understood as well as visualized. Verbalization is also required to convey the facts we know and understand. Recognition at that level is abstract and conceptual and can only be stabilized through verbalization. If there is objectivity in the findings, these will be persuasive, but if it is lacking, the evaluation will be unstable.

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The acquisition of objectivity through such visual modelling has been debated throughout the history of science (Daston and Galison, 2007). Indeed, graphical representations have contributed greatly to scientific recognition whereby objects of observation such as types of leaves, perfected snowflakes, and Martian sketches, for example, have been drawn and collections of drawings created in the form of atlases. While the construction of mathematical models is important for science, the construction of visual models is equally important, and the field of cartography is making the most of the latter. However, if the objectivity of maps is to be questioned, in addition to the conventional accuracy theory, a method should be developed to discuss the objectivity of maps semantically or epistemologically. In earlier research, the author psychophysically verified the meaning of map symbols by following the trajectories of eye movements (Morita, 1987). This study provided a graphical comparison of trajectory patterns (Figure 1) and presented the meaning of a map objectively through a visual model. However, the visual patterns were extracted and modelled from a large amount of original data in search of semantics. In today's technological environment, as has already been experienced with mobile guide maps, the human-machine context changes dynamically from moment to moment, and the corresponding maps also change. The degree of semantic matching in that dynamic flow has not yet been sufficiently tested.

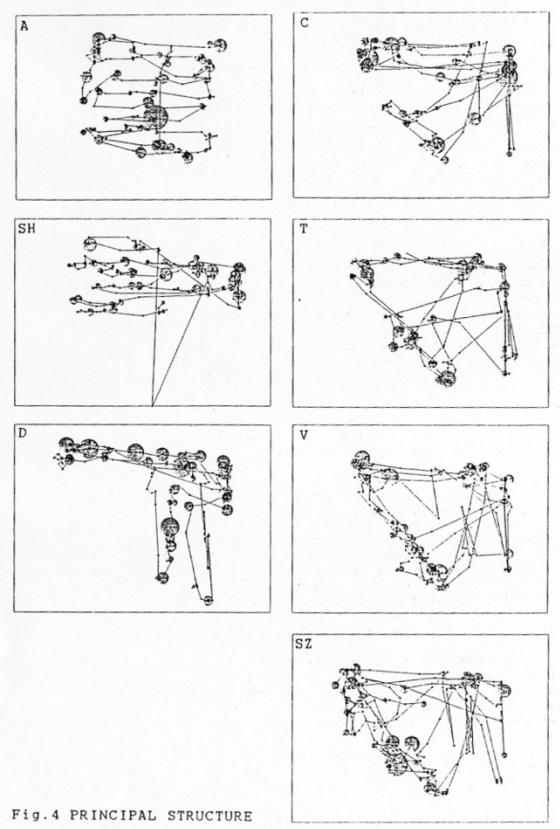

Figure 1 Comparison of trajectory patterns

In the general field of maps, the policy of checking the objectivity and validity of representation, especially in dynamic flow, is not well structured. Further discussions will be needed in the future to solve this issue.

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