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Maps as Tools of Thinking

Recent research on mobile communication sheds light on the fact that, while networked ICT devices make community formation and, generally, the flow of knowledge independent of geographical space, the knowledge of a primarily practical nature mediated by mobile communication remains location-sensitive.[1] Location-sensitivity means that, for example, a certain piece of information is relevant at a certain spot in a city, or in fact it can be interpreted only within the context of a given place and its neighbouring relationships in geographical space. This kind of knowledge may be called locative knowledge. However, very little is known about how we can determine the grade of location-sensitivity of a given piece of information. In this paper, I will examine the possibility of developing visual tools which, first, help to determine what kind of knowledge is locative, and, second, help to interpret short locative messages. Taking the patterns which appear on the maps of spatial annotation systems[2] as an example, I will argue that pictorial tools can be of use in this matter. Furthermore, I will examine how these patterns can be interpreted and attempt to outline a possible path for the instrumentalization of patterns.

Mobile Communication and Multimodality

When interpreting on-the-road communication, we often have to draw on the given situation. Truly mobile, truly locative information is as follows: "Get in!", "I'm on my way", "It's closed already!". What do we need in order to understand these short textual messages? Context that facilitates comprehension is an inherent aspect of the mental models of textual situations. This context may be comprised of associations deriving

[1] Cf. the section "The Global and the Local" (including articles by Meyrowitz, Poster, Strassoldo, Fortunati, de Gournay, and Harper) in Kristóf Nyíri (ed.), *A Sense of Place: The Global and the Local in Mobile Communication*, Vienna: Passagen Verlag, 2005.

[2] For details on spatial annotation systems, see the "Maps" subsection of this paper.

from both verbal and non-verbal (e.g., pictorial) systems.[3] For the examples above, context is provided by, in addition to knowledge of who sends the message to whom, geographical space, which can be visually represented by maps. Therefore, the modalities of message and context may differ. In such cases the image and the text, read and seen simultaneously, support each other, or as Kristóf Nyíri puts it:

> [A]lthough pictorial communication is seldom entirely successful if not accompanied by words, and any visual language needs the background of convention, pictures can indeed function as natural symbols due to their resemblance to the objects and facts represented.[4]

Both words and images can be more easily understood if we know the broader context in which they are embedded. The grammar of written and spoken language determines how we can compose sentences from words. In their book *Reading Images: The Grammar of Visual Design*,[5] Gunther Kress and Theo van Leeuwen describe the composition structures which have crystallized during the history of visual semiotics, demonstrating the use of these structures in contemporary image use. The authors translate linguistic modes of expression into visual ones, such as vectors, speech and thought bubbles, the organization and structuring of visual elements, framing, and camera angles. The modes of representation listed apply to still images. Kress and van Leeuwen suggest that the moving image may invoke semantic relations which the still image cannot. Nyíri sees the possibility of animating images as analogous to composing sentences from words: while a solitary word is harder to interpret, it gains a more definite meaning when it is embedded into a sentence.[6] If still images are animated, then, due to the dimension of time, series of pictures are more capable to represent logical structures and thus allow more definite interpretation.

Consequently, a picture can contribute to richer meaning when it is part of an animation. Similarly, a message can carry richer meaning if

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[3] Mark Sadoski and Allan Paivio, *Imagery and Text: A Dual Coding Theory of Reading and Writing*, Mahwah, NJ: Lawrence Erlbaum Associates, 2001, pp. 81–83.

[4] Kristóf Nyíri, "Pictorial Meaning and Mobile Communication", in Kristóf Nyíri (ed.), *Mobile Communication: Essays on Cognition and Community*, Vienna: Passagen Verlag, 2003, p. 157.

[5] Gunther Kress and Theo van Leeuwen, *Reading Images: The Grammar of Visual Design*, London: Routledge, 1996.

[6] Kristóf Nyíri, *op. cit.*, p. 179.

we can explore the communication pattern in which it is included. In both cases, we can speak of integration into a broader system of interrelations. In the first case, contextual elements are carried by the linear time dimension, and in the second case they are carried by space – geographical space, as we will see. The recognition of such elements as parts of a pattern may be illustrated with an example borrowed from Michael Polanyi:

> When flying first started pilots discovered the traces of ancient sites over which people had walked for centuries without noticing them. Back on the ground the flyers themselves lost track of the ancient sites. It would be nonsense to say that when by moving to some distance away we come to see a collection of parts as one whole we no longer see these parts. What happens is that we now see the parts in a new way, namely *as parts* of a whole.[7]

Maps

Spatial annotation systems are increasingly used with mobile devices. Maps included in these systems offer a bird's-eye view illustrated in the quotation above and they offer it on the computer screen or the mobile phone's display. It should be noted that numerous types of maps and visual representations exist. Even in the case of geographical maps, the intended end-use defines projection methods and distortions; a simple aerial photograph often doesn't make an optimal map.[8] Similarly, depending on intended use and the type of object represented, we can choose a representation which is topographical (Google Earth[9]) or, rather, topological (in the sense that the distance between elements is defined by the number of intermediate links, as in acquaintance networks, semantic networks, and maps of hyperdocuments). In the case of hyperdocument maps, the classic premise of cartography, the idea that the map is a representation of the terrain but never the terrain itself, does not apply.[10]

The Hungarian Virtual Encyclopedia[11] is not only a project for popularizing science, but also an experiment in the philosophy of science. Its entries, which contain primarily scientific and partly practical-every-

[7] Michael Polanyi, "What Is a Painting?", *The British Journal of Aesthetics* 10 (1970), p. 228.

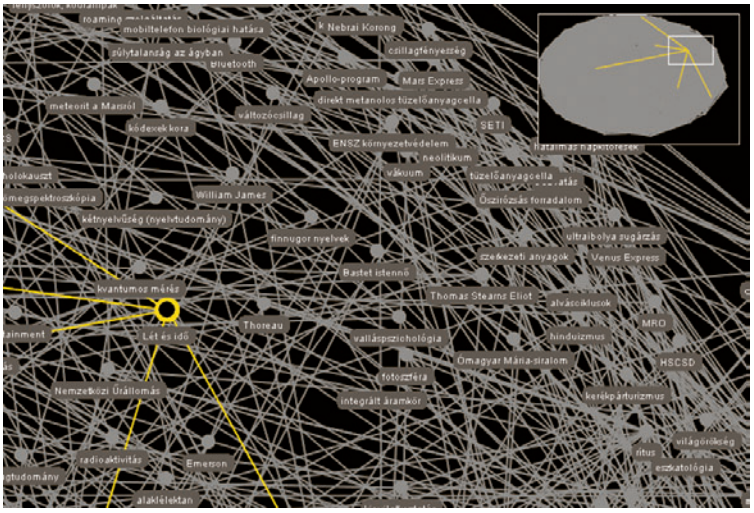
[8] Barbara Tversky, "Some Ways Graphics Communicate", in Kristóf Nyíri (ed.), *Mobile Communication*, p. 143.

[9] See http://earth.google.com.

[10] Martin Dodge and Rob Kitchin, *Atlas of Cyberspace*, Harlow: Addison Wesley, 2002.

[11] See http://www.enc.hu.

day knowledge, span a topological space by being interlinked. This space can be seen on a map developed for the encyclopedia, which is designed literally to give a *picture* of the structure of knowledge in the 21st century: the patterns of the knowledge network reveal the transitions between various fields of science, the convergence or divergence of these fields, and the internal structure of the entire body of knowledge.[12] The structure of this type of knowledge has only a slight, if any, dependence on geographical space. Therefore, the distance represented on the map between entries is not a mapping of geographical distance. Instead, an algorithm is used to calculate the positions of entries based on a weighted value derived from the number of links connecting entries directly or indirectly.



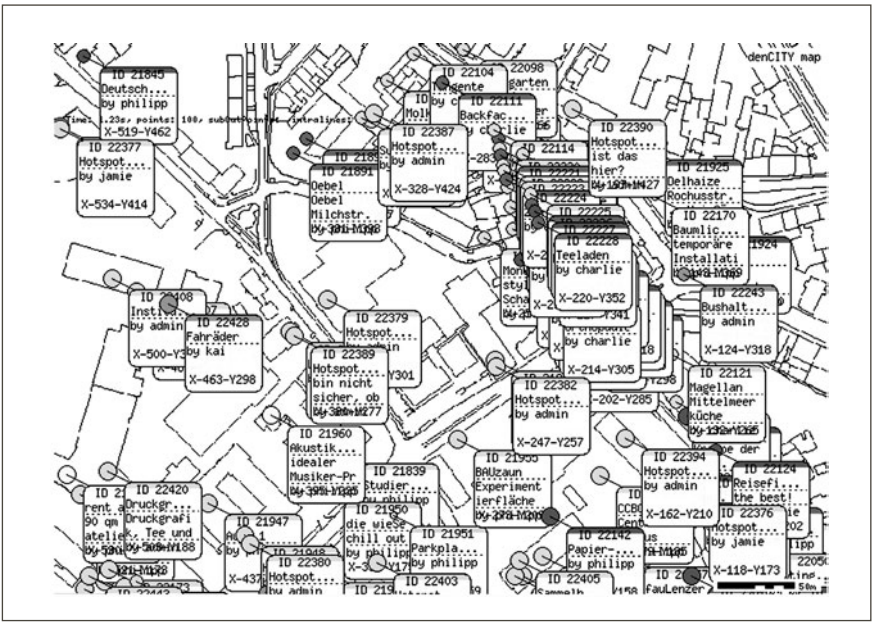
The map of entries in the Hungarian Virtual Encyclopedia (screenshot)

Community software (which supports the exchange of information, collaborative work, and chats), and in some cases databases of friendship

[12] Cf. Kristóf Nyíri, "Enzyklopädisches Wissen im 21. Jahrhundert", in his *Vernetztes Wissen: Philosophie im Zeitalter des Internets*, Wien: Passagen Verlag, 2004, see esp. pp. 166–168.

[13] See https://www.orkut.com, http://www.linkedin.com. Hungarian iwiw.hu (http://www.iwiw.hu) is also equipped with a map function which visualizes networks of acquaintances.

networks (e.g., Orkut and LinkedIn[13]) are also primarily topological. Spatial annotation systems are systems which allow us to associate messages (tags) with various points in geographical space via computers or mobile communication devices such as PDAs or mobile phones[14] (see the websites for Google Earth or denCity[15]). Depending on the system used, the spot to which a message will be attached can be either selected on a map by the user (Google Earth) or the message is assigned by the system to the current location of the user based on localization via GPS (STAMPS[16]) or mobile cell information (Shedlight[17]). I will illustrate the resultant patterns of organization through three views of Aachen, generated through three different settings of the denCity spatial annotation system.



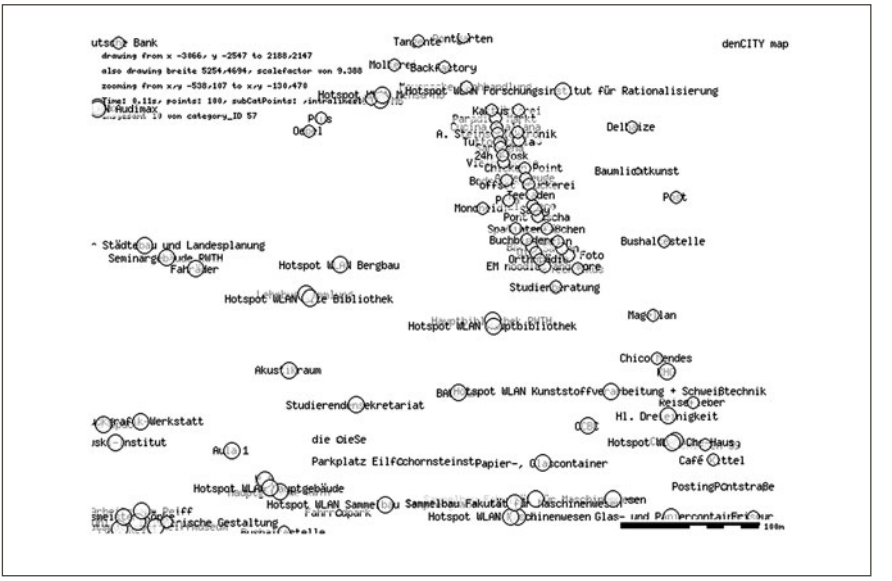
Full description for tags, including author and time stamp, with a street-level map

[14] A possible explanation of the difference between the diffusion speeds of mobile and computer-based blogging is that the former is often of a more personal nature than the generally public contents of web forums. Cf. R. H. R. Harper, "The Local and the Global: Paradoxes of the Mobile Age", in Kristóf Nyíri (ed.), *A Sense of Place*, p. 87.

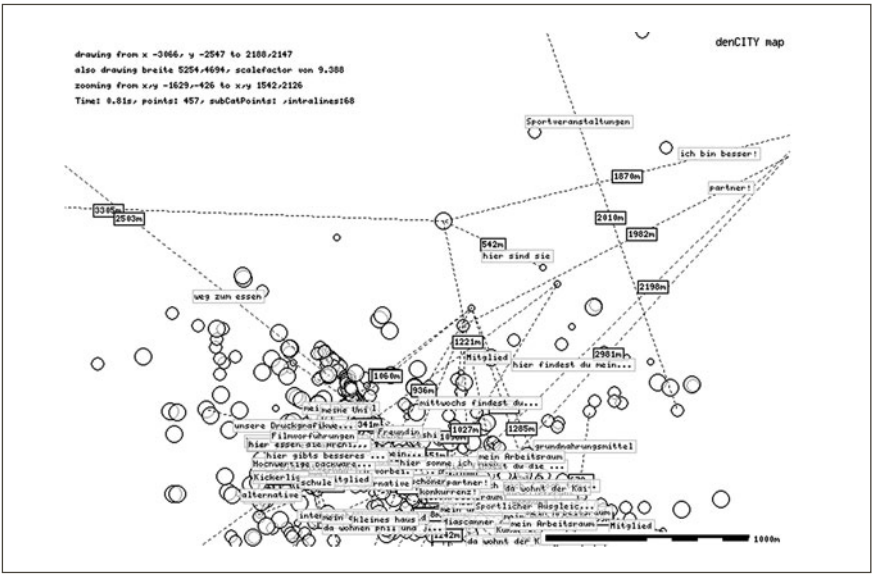
[15] See http://dencity.konzeptrezept.de.

[16] See http://craftsrv1.epfl.ch/research/stamps.

[17] See http://mobiled.uiah.fi/?p=32.



Brief entries for tags, no street-level map



A view visualizing thematic association between tags, no street-level map

The Patterns of Organization of Locative Information

Above, I briefly discussed the possibilities offered by linguistic and pictorial composition. However, pictures represented on the maps of spatial annotation systems are not compositions. Since the spatial distribution of messages is generally governed by the geographical distribution of individual messages rather than by grammatical rules or other conscious organizational principles, these patterns may be called patterns of organization. Such patterns which appear at the larger, community scale evolve from the distribution of messages appearing at lower (individual) levels. In the natural sciences, in computer-related media theory,[18] and in numerous other fields, we find different strategies to hierarchize levels of organization or levels of description. Creative human achievement and meaning often emerge at the higher levels or, in fact, the top level of such hierarchies. It would exceed the framework of this study to discuss how the higher level emerges from lower levels or how organization levels are related to each other. Rather, I will attempt to determine first principles of visual tools, be they mental or tangible, which allow us to interpret aspects of knowledge that are incomprehensible through solely textual tools.

How can we measure locativity for these patterns of organization? If, for instance, we assign the entries of an encyclopedia to different points in geographical space according to some arbitrary criterion (e.g., place of origin or geographical names included in the entries), then we get a quite random and static pattern. However, the user community probably applies a spatial annotation system because they consider it important for a given comment to be attached to a certain spot in space – usually, urban space. Of course, this does not imply that all short textual or pictorial messages included in the database of the spatial annotation system are locative. Locativity is defined by the structure and dynamics of evolving patterns. Instances of "Bless you!" will presumably produce a pattern on the map which is as homogeneous and random as the one received for the entry "Adaptation". In contrast, instances of "Come here!" will probably plot patterns which recur depending on location and time of day, and after a time we can have familiar patterns with definite meanings. Since there are currently few mobile spatial annotation systems which can reach enough users and are widely applied, such discussions are likely assumptions only.[19]

[18] Manovich proceeds from the code level to the level of culture. See Lev Manovich, *The Language of New Media*, Cambridge, MA: MIT Press, 2001.

[19] A list of links to spatial annotation projects can be accessed at http://www.elasticspace.com/2004/06/spatial-annotation. A promising project for Budapest is under preparation; the homepage can be found at http://emergentbudapest.org.

Pattern Instrumentalization

Let us now examine how a map, or the pattern emerging from a map, can become a tool. Some communication devices are handheld, others can be integrated into our bodies and become prostheses over time.[20] However, the cyborg was born before the high-tech era, since our language is also a tool which serves to ensure the cognitive capacity needed for the community life of humans.[21] The general principles of tool use apply irrespective of whether we examine tangible or mental tools. Therefore, when discussing tool use, we can rely on research concerning the operation of language. This parallel is also underpinned by Michael Polanyi's concept of tools and views on the operational principles of language.

Tools can be more than sticks and hammers; there are also intellectual tools such as interpretative frameworks and, as Polanyi argues, the formalism of the exact sciences can also be mentioned here.[22] It is applicable to both linguistic and other tools that within an operational field we "dwell" in these tools, having only a subsidiary awareness of them, while our attention is directed towards the goal to be achieved, which carries the real meaning. When we learn to use language, as well as other tools such as a stick or a probe, "we shift outwards the points at which we make contact with the things that we observe as objects outside ourselves",[23] which is the result of a lengthy learning process rather than a spontaneous event.[24] Medics acquire the skill of interpreting spots on an X-ray of the lungs.[25] Similarly, an integral part of the researcher's work in the natural sciences is the ability to interpret pictures received through various imaging methods, which can involve exploring entirely new pat-

[20] Cf. Ian Hacking, "Genres of Communication, Genres of Information", in Kristóf Nyíri (ed.), *Mobile Understanding: The Epistemology of Ubiquitous Communication*, Vienna: Passagen Verlag, 2006, p. 29, and John Preston's discussion concerning "active externalism" and "the extended mind thesis": John Preston, "Is Your Mobile Part of Your Mind?", in Kristóf Nyíri (ed.), *Mobile Understanding*, pp. 67–75.

[21] Robin Dunbar, "Are There Cognitive Constraints on an E-World?", in Kristóf Nyíri (ed.), *Mobile Communication*, p. 61.

[22] Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy*, London: Routledge & Kegan Paul, 1962 (corrected ed., first published 1958), p. 59.

[23] *Ibid.*

[24] Michael Polanyi, "The Unaccountable Element in Science", in Polányi, *Knowing and Being*, London: Routledge & Kegan Paul, 1969, p. 106; Michael Polanyi, *The Tacit Dimension*, London: Routledge & Kegan Paul, 1966. pp. 14–15.

[25] "Sense-Giving and Sense-Reading", in Michael Polanyi, *Knowing and Being*, pp. 188–189.

terns.[26] A perceived pattern can be new when the investigators are confronted with it while using a tool which is new to them – in such cases, everything is new – but it can also be new when they perceive a pattern different from familiar patterns when using a familiar measuring tool. Patterns visible on maps of spatial annotation systems have not yet reached the status of well-established tools for interpreting locative practical knowledge, so recognizing such patterns can now be considered to belong to the first case.

What are the criteria for instrumentalizing pictorial patterns? The patterns which carry relevant meanings emerge from the distributions of lower-level elements by way of repeated appearances. However, since "the world … never exactly repeats any previous situation … we must decide what variations of our experience are irrelevant to the identification of this recurrent feature".[27] In Polanyi's terms, what we have to do with here is one of the operational principles of language, the law of consistency. This achievement of perception, which highlights the relevant features of patterns, reveals order in chaos, and tames the wilderness, draws on the interaction between the internal and external structures of human beings through schemas which were either internalized during the individual learning process or developed in the course of evolution (such as a sketch of tree-branches, the image of a hand, etc.).[28]

As soon as some features of emerging patterns recur, similarity between current patterns and those seen earlier can be perceived, and pictures appearing on the map begin to function as natural signs. The recognition of similarity between recurring patterns in the later Wittgenstein's concept of a language-game is the recognition of family resemblances between language situations – of patterns comprising features of smaller and larger scales. Wittgenstein considers *Muster* (which stands for both "sample" and "pattern"), as well as words and pictures, to be instruments of language. The following quotation shows the paradigmatic use of this word

[26] An often cited example from the times preceding the spread of computer-based imaging methods is the role of X-ray diffraction pictures in discovering the double-helix structure of DNA. Cf. Martin Kemp, "Wissen in Bilder – Intuitionen in Kunst und Wissenschaft", in Christa Maar and Hubert Burda (eds.), *Iconic Turn: Die neue Macht der Bilder*, 3rd ed., Köln: DuMont, 2005, p. 402.

[27] Michael Polanyi, *Personal Knowledge*, pp. 79 f.

[28] For a discussion of "structural intuition", see the article by Martin Kemp, an art historian with a strong natural science background: "Wissen in Bilder – Intuitionen in Kunst und Wissenschaft", *loc. cit.*, p. 383; for a discussion of schemas developed in the course of evolution, see Barbara Stafford, "Neuronale Ästhetik – Auf dem Weg zu einer kognitiven Bildgeschichte", in Christa Maar and Hubert Burda (eds.), *Iconic Turn*, p. 111.

(in the sense of "sample"), which is essentially based on similarity:

> when I say to someone: "Pronounce the word 'the'", you will count the second "the" as part of the sentence. Yet it has a role just like that of a colour-sample in [a pertinent] language-game…; that is, it is a sample of what the other is meant to say.[29]

At another point we can find an explicit reference to how the order, distribution, and sequence of words may produce a pattern which carries meaning.

> In introducing the distinction, "word, pattern", the idea was not to set up a final logical duality. We have only singled out two characteristic kinds of instruments from the variety of instruments in our language. We shall call "one", "two", "three", etc. words. If instead of these signs we used "-", "--", "---", "----", we might call these patterns. Suppose in a language the numerals were "one", "one one", "one one one", etc., should we call "one" a word or a pattern?[30]

Wittgenstein's concept of *Muster* leads us back to the point where individual words as constituent elements of pictures become parts in creating a fuller meaning, or, to put it in another way, pictures, transformed into symbols, are built into our language-games.

Conclusion

In the section "The Patterns of Organization of Locative Information", I have demonstrated how the patterns observed on the maps of spatial annotation systems can serve as tools for defining what true locative information is. As a practical effect, such an examination might facilitate the development of systems tailored for specific communities, issues, or activities. Taking into account the visualized information's grade of locativity might determine the weight of topological and/or topographical distance on the depiction. Topographical maps usually help navigation through the city, while topological maps help visualize the relationships between keywords in a citation network or entries in an encyclopedia.

[29] Ludwig Wittgenstein, *Philosophical Investigations*, transl. by G. E. M. Anscombe, Oxford: Basil Blackwell, 1953, § 16.

[30] Ludwig Wittgenstein, *The Blue and Brown Books*, Oxford: Basil Blackwell, 1958, p. 84.

In addition to distinguishing different types of knowledge, the patterns described can be used to illustrate the gradual transition between these types.

The philosophical relevance lies in these patterns enabling knowledge to emerge out of locative practical information through visualizing the necessary context. In the very same way, such knowledge becomes shareable. If the instrumentalization of patterns on spatial annotation systems' maps and the like is realized, we will gain a visual tool (that is, a multimodal tool which has, among other characteristics, pictorial aspects) for representing knowledge which has remained subtle and tacit so far, but is by no means irrelevant.