

**Position paper for challenge 2: How can we best develop a systematic understanding of the intersection between human abilities (perceptual/cognitive/affective), cartographic design decisions (graphic & interaction), and map use context? Can we predict what will work?**

## **We need a model of context factors that affect map use as a basis for cartographic design decisions**

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The pillars of cartographic design are map theme (What is to be presented?), map purpose (What is the map used for? How are the users using the map? Where are they using the map? Which device is used for displaying the map?), and target audience (Who is going to use the map?). Looking at these three aspects the map design process seems like a straight-forward process that can be accomplished step by step.

In practice however, we observe that map interpretation is much more complex and depends on a high number of aspects – the map maker cannot anticipate all of them and if so she cannot design a map that is suitable for all eventualities at the same time. This is for a number of reasons: Although the general map theme is given, there is a variety of user intents and tasks that do not need to be in line with the map maker's intent. The map maker, e.g., wants to give an overview about an environmental phenomenon in a city, the user on the other hand uses the map to infer individual critical values in her neighborhood. Additionally there is a number of aspects concerning map use that cannot be anticipated. Users use a big variety of devices that differ in resolution, viewing angle, hardware (e.g. screen technology), and interaction mode etc. In contrast to desk-bound PCs of the older days recent mobile technology is used indoors, outdoors, mobile, as well as stationary. They can be used with an external screen or keyboard, which both has implications on map use. The environment of map use, together with device specifications, influences the appearance and thus perception and interpretation of maps. A high number of lightness steps in sequential schemes, e.g., might not be distinguishable under certain lighting conditions in outdoor use. Also some color vision deficiencies appear at a higher number under certain viewing conditions, e.g. a smaller field of vision (Schuhmann und Mueller, 2002). Last but not least also the target audience for many map products cannot be specified clearly and is composed, e.g., by well-educated users with prior knowledge but also laymen with little map use skills.

To deal with intersections between human abilities (perceptual/cognitive/affective), cartographic design decisions (graphic & interaction), and map use context the author suggests to build a model, comparable to the model in fig. 1 for mobile interaction. The model would give an overview of context factors that affect map use and would function as a basis for cartographic design decisions.

The author defines context as the overall situation of map use, including the user, the device, and the map design, because the effects of these spheres interact with each other. Users' perception, as part of human abilities, is e.g. on the one hand inherent and on the other hand dependent on the lighting condition (environment of map use), the screen settings and technology (device), and the size of symbols and contrast (graphic map design). Context in cartography has been addressed especially in mobile cartography regarding the subject of context-awareness that is sometimes equated with location-awareness. However, considering context is also of high importance for other than mobile contexts because the classic desk-bound PC map use has been replaced by a variety of *flexible* map use scenarios with variable devices.

Defining the context of map use the author suggests two subordinate spheres, culture and environment of map use, as in the model below. These are the spheres in which a map use scenario is taking place. The map use scenario has three interacting spheres: the user, consisting of user characteristics, human abilities (perceptual/cognitive/affective), user intent, and tasks (cf. e.g. Andrienko and Andrienko, 2006); cartographic design, consisting of graphics and interaction;

and the device, consisting of device specifics, such as hardware or interaction mode. Obviously the sphere that is most complex and uncertain is the user. The device is a determining factor, as well as culture and environment. All three can be influenced by the user and partly deliberately chosen, even spontaneously. Cartographic design is a dependent factor, depending on the user and the device. Especially the connection of user and cartographic design needs closer attention; individual connections have to be defined and weighted according to relevance.

The better we specify context factors, the better we will be able to predict if a cartographic design will work or not. In a future scenario an adaptive system would decide on map content, design and interaction, based on weighted context factors.

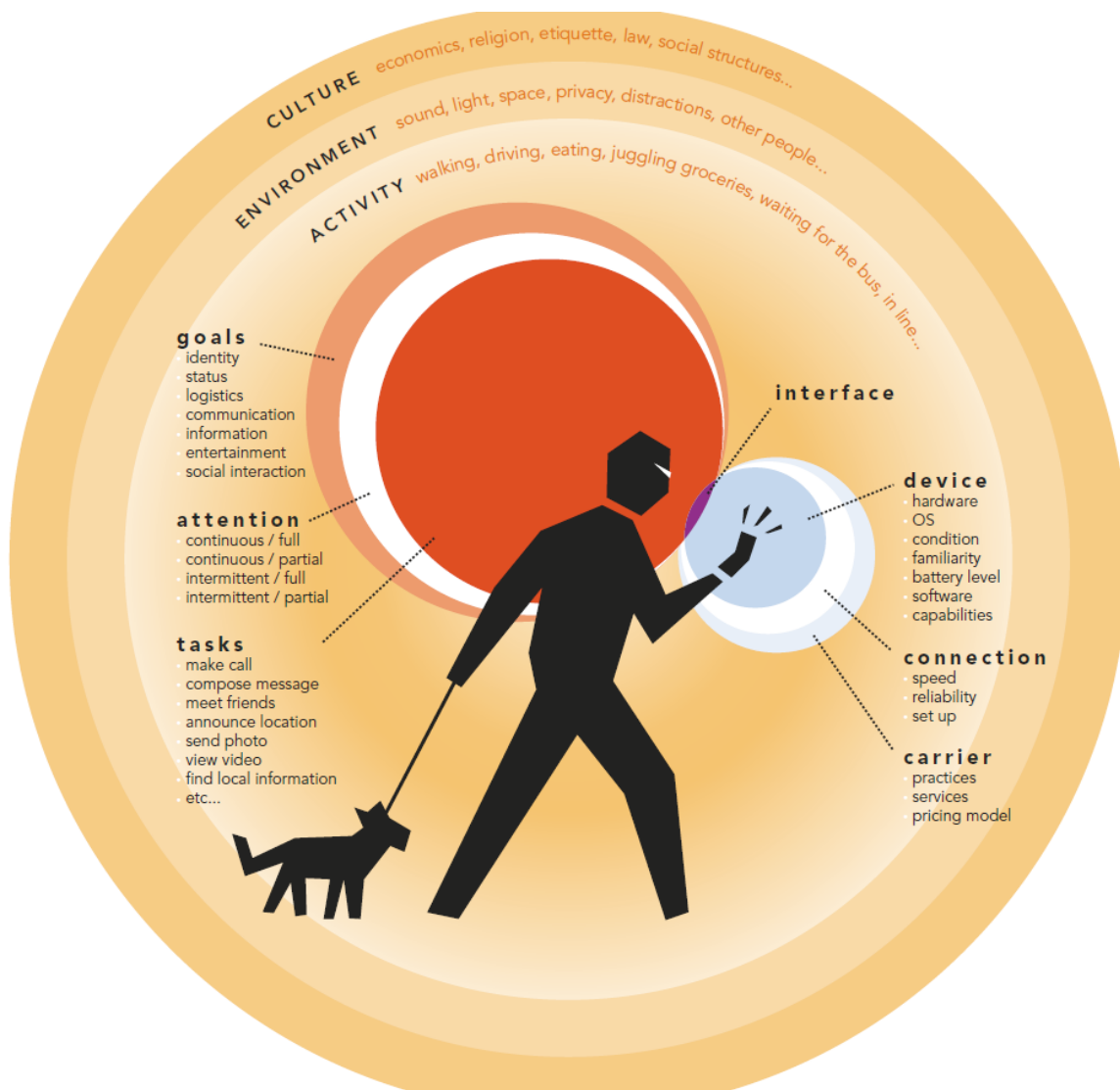


Fig. 1: Model of context for mobile interaction that shows the overlapping spheres of context (Savio and Braiterman, 2007).

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**Sources:**

Savio, N. and J. Braiterman (2007). Design Sketch: The Context of Mobile Interaction. In Mobile HCI 2007, September, 2007, Singapore.

Schumann, H. and W. Mueller (2000). Visualisierung: Grundlagen und Allgemeine Methoden. Springer: Berlin, Heidelberg.