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Schematizing Crossroads from Abstract Textual Descriptions

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The use of cartographic representations among people with visual impairments (PVI) is often limited by the lack of available materials. However, two uses have been identified: diagrams made with sticks magnetised to a metal plate (Figure 1) are used by Orientation and Mobility instructors as a discussion aid around complex areas (typically intersections), and more accurate maps made by transcribing adapters are sometimes produced for regular use. While classical variations of the generalisation and stylisation approaches allow for the production of fairly accurate maps [JLCJ21], for example from OpenStreetMap data (figure 2), there are currently no known approaches to producing a more schematic representation, in the manner of the locomotion instructors’ magnets.

Mackaness and Reimer define schematized maps as ”bereft of detail, emphasising properties such as causality, connectivity, and flow”, where abstraction is more important than the correct geographical location [MR14]. Hence, a schematized map seems to be a good way to graphically represent crossroads to PVI: the map should be easy to read by fingers; it should focus on footways (sidewalks, crossings), and identify the dangerous space dedicated to cars with a specific texture.

In order to produce a synthetic map satisfying these objectives, we propose to describe sidewalks by lines, traffic islands by discs, zebra crossings by simple pictograms, and to fill in the road with an easily identifiable texture (Figure 3), taking care to keep a white space between the objects to facilitate their tactile reading.

The production of a schematic representation of a crossroad we propose is based on the representation of the crossroad in an abstract representation model, integrating the different functional elements of a crossroad: branches, lanes, pavements, pedestrian crossings [KFT21]. This abstract model is dedicated to generate a textual/sound description that accompanies the tactile map.

We therefore propose to reconstruct a simplified geometric instance for each element of this abstract representation. A simplified geometric instance of sidewalks (using straight lines along each branch) is registered on the OpenStreetMap data to match the global shape of the crossroad (step 1). A regularization step is then applied to the sidewalk lines to obtain orientations proportional to $\pi/4$, in a similar process to metro map schematization [NW11] (step 2); circular pictograms and zebra pictograms are located at the adjusted location of the traffic islands and crossings (step 3); the road area is reconstructed from the sidewalk lines, and filled with a recognizable texture (step 4); blank spaces are generated using an offset algorithm from sidewalk lines and pictograms (step 5).

We plan to implement these algorithms in the next months and test with PVI if the schematized map is more usable than the accurate tactile maps.

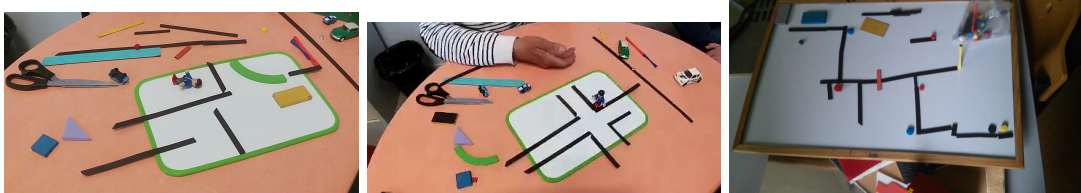


Figure 1: Three examples of maps made with magnets

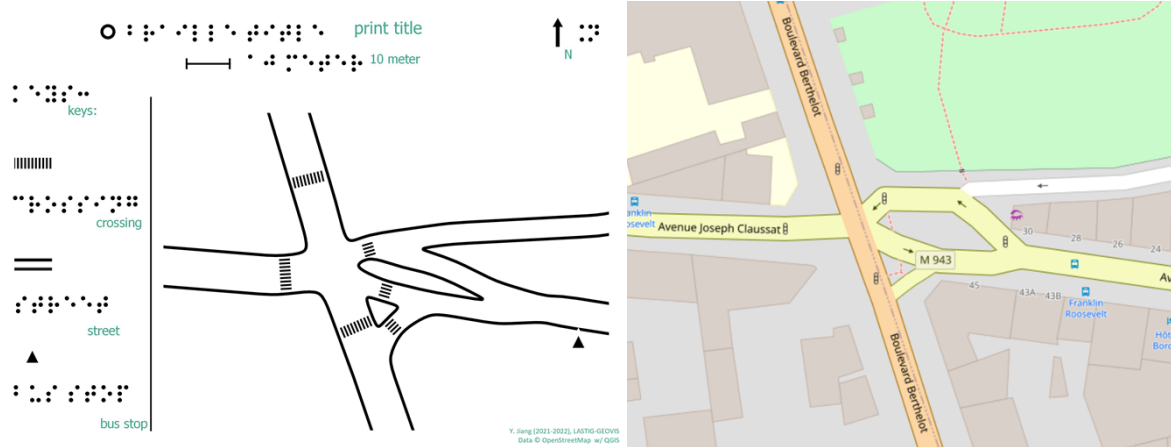


Figure 2: A 2D view of a tactile map (copyright Yuhao Markie Jiang), and the corresponding intersection in OpenStreetMap.

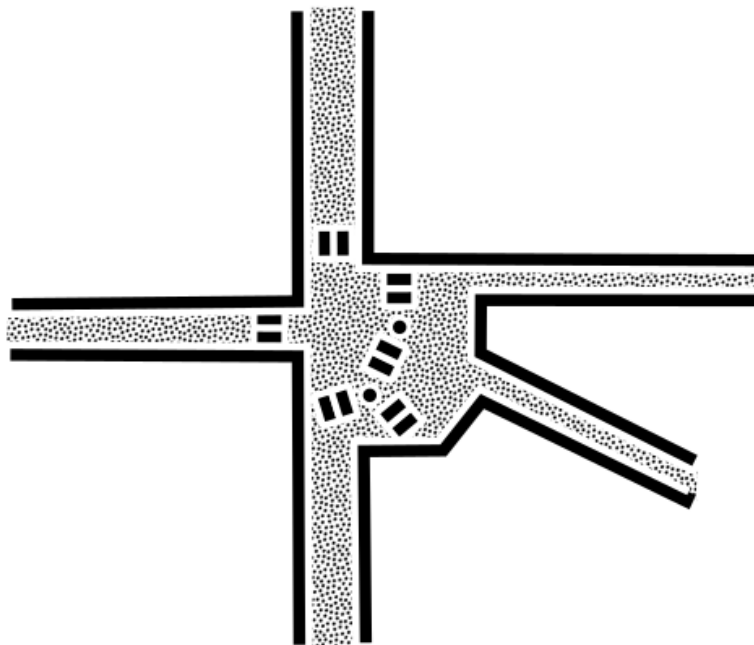


Figure 3: A manually generated schematised map of the crossroad from Figure 2, based on the textual description and conflated with the geographic data.

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