Towards Multisensory Cartography

A Review of the Auditory & Haptic Communication of Space & Place in Interactive Applications

By NTUA

The Haptic Dimension

& approaches discussing touch with other senses

Cartography for blind & visually impaired users
The haptic variables
Other recent approaches (ubiquitous maps, Universal Design, aesthetic qualities of touch)

# Cartography for Blind & Visually Impaired (BVI) Users

Developed with contributions from various scientific fields.

Traditional (non-interactive) tactile maps: Effective, but have important limitations.

Considerable research on tactile maps, e.g.
- Tactile variables (Vasconcellos, 1993)
- Map reading strategies (Perkins & Gardiner, 2003)
- Optimal tactile elevation (Jehoel et al., 2009)
- Thematic (Lawrence & Lobben, 2011) and environmental symbols (Lobben & Lawrence, 2012)
- 3D printing (Gual et al., 2014)
- Spatial pattern cognition (Perdue & Lobben, 2016)
- Automatic map generation (Wabiński & Mościcka 2019)
- Standardization (Wabiński et al. 2022) – although this has not been achieved.
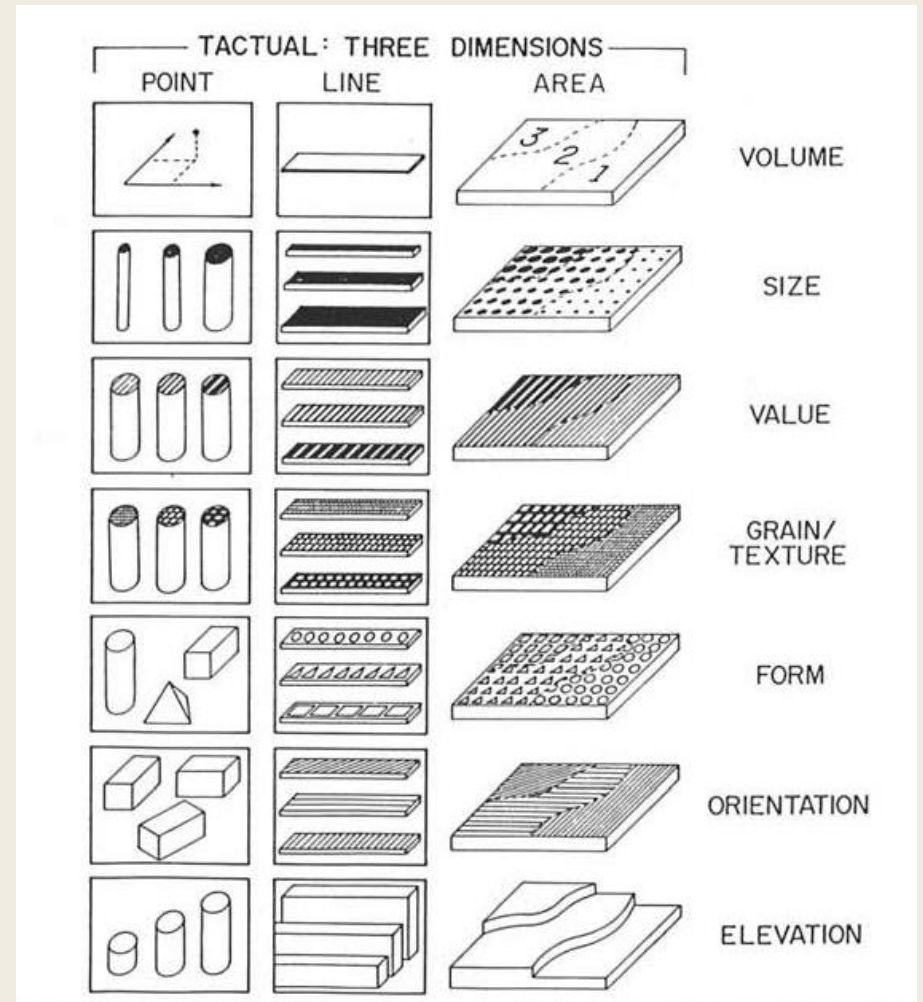
Tactile variables (Vasconcellos 1993)

Other approaches: Griffin (2001)

Haptic variables, to explore representations of geographic phenomena in virtual environments, as a complement to **visual** presentation

- Premise: Visualization is primarily a **cognitive** process (MacEachren & Ganter, 1990)

- Haptic perception is active and exploratory, therefore **intuitive** for the exploration of geographical phenomena.

- Because of the realism of virtual environments, the recommended use of the variables may be **iconic**, particularly when visual representation of a phenomenon is not possible.

Griffin, 2001

Basis: Analysis of the physiological properties of haptic sensations

- Variables derived from touch

- Variables also perceived visually

- Kinesthetic variables resulting from changes in the position of the user or the stimulus

Haptic variables (Griffin 2001)

Other recent contributions

Magnusson et al. (2009) — Maximize potential of using sound and touch for **usability** and **accessibility**

ICA publications — References to sound and touch, e.g. ICA Research Agenda 2009, Research Agenda on context & transferability, Review of LBS

Lobben et al. (2015) — Proposed the adoption of **Universal Design/ Design for All**

Ruginski et al. (2022) — Design principle to make navigation systems more accessible and multimodal (UD)

Rossetto (2019) — **Empathy** of touch

Kent (2019) — **Aesthetic** and cognitive potential of touch