Gardony Map Drawing Analyzer: A Novel Approach to the Analysis of Sketch Maps

Aaron L. Gardony¹,², Tad T. Brunyè²,¹, & Holly A. Taylor¹

¹Tufts University, Medford, MA  ²US Army NSRDEC, Natick, MA

Introduction

- Spatial cognition research often uses sketch maps to assess environment knowledge and spatial memory (Newcombe, 1985).
- Despite their wide use, analysis & scoring of sketch maps remains cumbersome and unstandardized. Current techniques often:
  - Are time-consuming and/or computationally intensive
  - Consider few facets (e.g., recalled landmarks, overall orientation)
  - Use experiment-specific techniques ("reinventing the wheel")
- Bidimensional regression (BDR) (Friedman & Kohler, 2003; Tobler, 1994) is commonly used for sketch map analysis. BDR:
  - Provides a single measure of resemblance between 2-D coordinate configurations
  - BUT, the sketch map and target environment must have the same # of points for comparison.
  - Thus BDR cannot be used with incomplete maps, yet memory is often incomplete!
- In order to standardize sketch map analysis we have developed publicly available analysis software, the Gardony Map Drawing Analyzer (GMDA). GMDA provides an easy-to-use interface that scores sketch maps using both traditional BDR and novel measures.
- Here, we introduce the software, its measures, and preliminary experimental validation.

The Software

- Compares the sketch map’s landmark coordinates to target environment using pairwise comparisons and BDR
- User can input target environment coordinates manually or graphically.
- Coordinates files can be saved & re-used on multiple sketch maps.
- Software saves:
  - Analysis files containing measures unique to GMDA as well as BDR
  - Configuration files of landmark locations to afford quick reanalysis

GMDA Measures

- Sample: 40 Tufts undergraduates (18 male, M age = 19.2)
- Both GMDA & BDR represent landmarks with single points (e.g. coordinates).

Validation Experiment – Methods

- Adjust landmark canonical relationships, distances, & angles

- Environment Exploration 30 min OR 9 min

- Map Drawing

- Virtual Pointing

- Goal Navigation

Results

- Map Analysis

- Short exposure leads to impoverished environment knowledge. Canonical Organization reflects this. BUT BDR measures did not differ b/w conditions.

Future Directions

- Both GMDA & BDR represent landmarks with single points (e.g. coordinates).
- We are developing a new software mode that represents landmarks with boxes to address these issues.
- This novel approach inputs the coordinates of a landmark’s bounding box into existing GMDA and BDR calculations.

How does GMDA relate to BDR?

- GMDA is a publicly available sketch map analysis tool that:
  - Assesses inter-landmark canonical relationships, distances, & angles using novel and traditional methods (BDR)
  - Provides better measures of incomplete knowledge than BDR
  - Experimental evidence presented here validates the tool’s measures.
  - BUT why the lack of differences b/w exposure conditions?
  - Spatial knowledge after short exposure is incomplete but accurate.

Discussion

- Both GMDA & BDR represent landmarks with single points (e.g. coordinates).
- Experiment these differences.

Try GMDA here:
sites.google.com/site/agardony/tools

References

