Diagrams to Augment Cognition

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Diagrams : A Cognitive Tool

Diagrams, such as maps, charts, graphs, and widely used as cognitive tools to promote memory and information processing, serving a variety of situated roles. They offload limited capacity working memory; they promote the use of space in inference and reasoning, they provide common ground for collaborative design (e. g., Kirsch, 1995; Larkin & Simon, 1987; Tversky, 2001).

One reason for the effectiveness of diagrams is that they map real or conceptual elements and relations to graphic elements and spatial relations in diagrammatic space. Diagrams have a rudimentary semantics and syntax. Diagrammatic elements, such as lines, blobs, crosses, and arrows have many possible interpretations derived from their geometric properties, but are disambiguated in context, much like the verbal concepts they approximate, such as relation and area. The elements can be combined in constrained ways to produce a multitude of meanings. This schematization has been a consequence of long term interactive situated use. Diagrams also use the spatial relations among elements to convey conceptual relations preserving varying levels of information, categorical, ordinal, interval.

Diagrams for Clarity

Diagrams can be used to organize and convey information and instructions, as in route maps and assembly directions. Here, the primary use is to instill prescribed information or linear actions. This will be exemplified by two projects on production and use of diagrams, one in route finding and the other in object assembly.   In both cases, descriptions and depictions reveal the same underlying conceptual structure for traversing a route or assembling an object.   These structures include both representations and procedures.

Diagrams for Creativity

Diagrams can also function to aid inference and promote creativity. Here, the goal is to come up with new ideas, ideas not anticipated by the designer of the diagram. This will be described by Suwa (2002; Suwa & Tversky, 2001) in a project on diagrams generated and used in design.

In both cases, diagrams are inevitably replete with ambiguity. In the former, context disambiguates, instilling clarity and avoiding confusion. In the latter, ambiguity is a resource for creativity.

Acknowledgments

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