

Thinking Graphically: Connecting Vision and Cognition During Graph Comprehension

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Task analytic theories of graph comprehension account for the perceptual and conceptual processes required to extract specific information from graphs. Comparatively, the processes underlying information integration have received less attention. We propose a new framework for information integration that highlights visual integration and cognitive integration. During visual integration, pattern recognition processes are used to form visual clusters of information; these visual clusters are then used to reason about the graph during cognitive integration. In 3 experiments, the processes required to extract specific information and to integrate information were examined by collecting verbal protocol and eye movement data. Results supported the task analytic theories for specific information extraction and the processes of visual and cognitive integration for integrative questions. Further, the integrative processes scaled up as graph complexity increased, highlighting the importance of these processes for integration in more complex graphs. Finally, based on this framework, design principles to improve both visual and cognitive integration are described.

Keywords: graph comprehension, diagrammatic reasoning, eye tracking

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Imagine a health scientist attempting to contain the flu epidemic. The scientist may study a population density graph (similar to Figure 1) depicting the number of flu cases by county. To allocate the limited flu vaccine, the scientist may want to know the specific number of cases in a particular county or the general trend of infected cases. What cognitive and perceptual processes are used to extract these different types of information from a graph?

Specific information extraction involves searching for a specific data point and determining the quantity represented by the data point. Integrating information, which is required to determine the trend in a graph, demands the extraction of multiple data points and interpretive processes to combine this information into a

coherent representation. The goal of this article is to examine the cognitive and perceptual processes used to extract specific information and to integrate information, with an emphasis on the integration process. We elaborate on existing frameworks of integration and provide guidelines to facilitate integration in graphs.

Specific Information Extraction

Most theories of graph comprehension have focused on the cognitive and perceptual processes underlying specific information extraction from graphs. Specifically, task analytic theories (Kosslyn, 1989; Lohse, 1993; Pinker, 1990) provide process description of specific information extraction with a focus on relatively simple graph types (i.e., bar and line graphs). These theories are remarkably consistent, suggesting the following stages of processing: (a) pattern recognition occurs, whereby graph readers encode the visual array and identify visual features of the graphical pattern; (b) conceptual relations are determined, giving rise to the quantitative meaning of the visual features; and (c) referents of the graph are related to the encoded visual features.

Several empirical studies have provided support for the task analytic theories' account of specific information extraction by examining the specific processes that comprise the general stages outlined previously (Carpenter & Shah, 1998; Lohse, 1993; Peebles & Cheng, 2003). First, parts of the question may be read multiple times (Peebles & Cheng, 2003). Next, the participant searches for the specific information on the graph (Stage 1), shifting from the axes to the main part of the graph and back again (Stage 2; Carpenter & Shah, 1998; Lohse, 1993; Pinker, 1990).

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Thinking Graphically Connecting Vision And Cognition

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Thinking Graphically Connecting Vision And Cognition:

The Top Books of the Year Thinking Graphically Connecting Vision And Cognition The year 2023 has witnessed a remarkable surge in literary brilliance, with numerous compelling novels captivating the hearts of readers worldwide. Lets delve into the realm of top-selling books, exploring the captivating narratives that have captivated audiences this year. The Must-Read :

Colleen Hoover's "It Ends with Us" This heartfelt tale of love, loss, and resilience has captivated readers with its raw and emotional exploration of domestic abuse. Hoover expertly weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can triumph.

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Thinking Graphically Connecting Vision And Cognition : Delia Owens "Where the Crawdads Sing" This evocative coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens crafts a tale of resilience, survival, and the transformative power of nature, entrancing readers with its evocative prose and mesmerizing setting. These popular novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of captivating stories waiting to be discovered.

The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts.

The Secret History is a brilliant and thrilling novel that will keep you guessing until the very end. The novel is a cautionary tale about the dangers of obsession and the power of evil.

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