Building networks to facilitate task-switching and metacognition in complex analysis

Barbara Mirel
University of Michigan

In critiquing network visualizations such as Cytoscape it is important to point out that the critiques assume that the networks are used for complex exploratory workflows. In these explorations, people progressively uncover patterns of concepts and interacting entities to gain new insights into causal and conditional relationships. Ddomain specialist-users expect the interactive graphs to facilitate a coherent, analytical workflow. Unfortunately, this coherence is often not experienced by users in visual analytics that I study – bioinformatics and biological networks. Usability research in this domain shows that interactive visualizations do not sufficiently support users fluently in the higher order reasoning that is necessary for deep insights and discovery (Saraiya et al; Seo and Shneiderman).. Based on NetSci's emphasis on humanities and the arts, I will present lessons that our National Center of Integrative Biomedical Informatics (NCIBI) has learned for overcoming coherence problems in visual analytics. These lessons can guide the development of networks in other domains so that networks will build in this aspect of usefulness from the start.

Our experiences reveal the importance of integrating a user perspective into technical advances and innovative network designs. Without this perspective, visual analytics may not foster deep insights as desired. As lead usability specialist at the NIH-funded NCIBI, my team has studied the graph designs needed for supporting the task switching and metacognition intrinsic to coherent, complex analytical workflows. We have studied users in the field and have conducted usability studies on Cytoscape-based visualizations. In my talk I will focus on users' needs for task switching and metacognitive monitoring in complex analysis for discovery and hypothesizing purposes. Many of these needs are transferable beyond the sciences. I will detail the cognitive tasks characterizing effective task switching and metacognition and map these tasks to requirements for interactive networks.

MiMI plug in for Cytoscape from the NCIBI:
http://portal.ncibi.org/gateway/mimiplugin.html
http://portal.ncibi.org/gateway/tutorials/Module3_MiMIPlugin_Tutorial.pdf

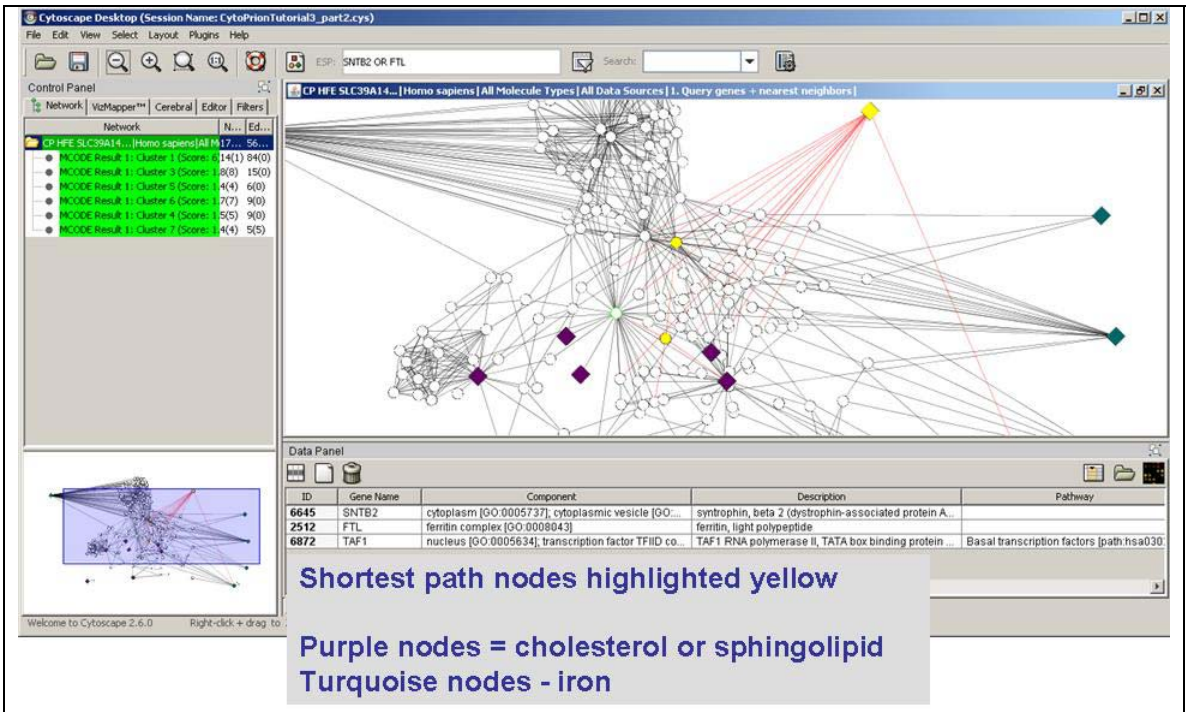

Figure from a complex flow of analysis using the MiMI plugin to Cytoscape. Intended to reveal the multidimensional relationships involved in one task, which will soon switch to another task and require metacognitive monitoring of evolving progress and insights.