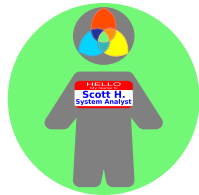


# Flow Visualization



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## Overview

I demonstrate the use of a combined material and data flow model that uses three symbols to vet, analyze, plan, change, and maintain complicated systems. I show how to create interactive models and narrative documents using these methods from the ground up, without relying on external services.

This document is incomplete. I will work on it over time and remove this notice when finished.

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# Introduction

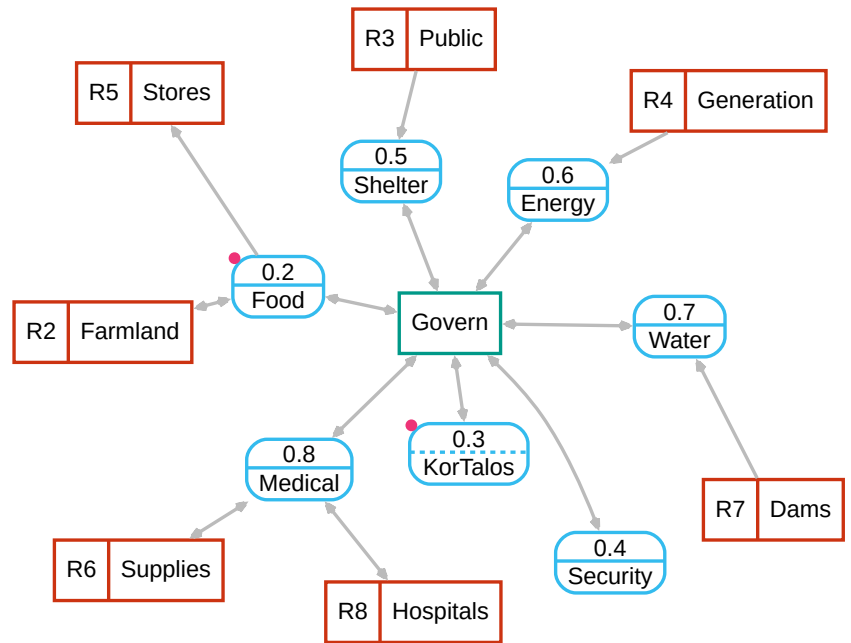
My two previous papers Triple System Analysis ( [3sA](#) ) and Adaptive Analysis ( [AA](#) ) explain how to use multi-level knowledge graphs for system analysis ( [H. 2023](#) ) [↗](#) ( [H. 2024](#) ) [↗](#). Flow Visualization ( [FV](#) ) simplifies the symbols of the combined material/data flow model of [AA](#) . Read [3sA](#) , [AA](#) , and [FV](#) in order.

## Human Cognition First

We tend to work with systems backwards. We look at the exhaust data from systems and hope to understand our direction, when we should really be focusing on where we are, where we want to go, and what dangers lie on our route before looking at the currents propelling our boat. Our systems should conform to our needs, not the needs of a provider, framework or existing systems. There can be some savings in the short-term by going with the flow and purchasing the dominant service; however, when rapid change in requirements and features are needed to adapt to new situations, the technical debt accumulated by not leading with human cognition increases the risk of capsizing in the rapids.

To get our bearings, humans can consider roughly 3 classes of objects related in one dimension, which can be seen as players, tools, and teams towards a common goal ( [Tomasello et al. 2005](#) ) [↗](#). We have limits on how much information we can consider in real-time to make decisions ( [Zheng and Meister 2025](#) ) [↗](#). What form of knowledge works best for the thin layer of communication that comprises our conscious mind ( [Murphy et al. 2011](#) ) [↗](#) ( "Decoding the Void" n.d. ) [↗](#)? Semiotics are cognitive shortcuts that can help. I use icons for [3sA](#) , [AA](#) , and [FV](#) , rather than titles, to make it clear that I mean the idea of the entire paper. I use other conventions in the model to help the reader understand complex systems without dense dialog. I have had professional success using knowledge graphs and semiotics in the form of Gane and Sarson structured systems analysis ( [H. 2023](#) ) [↗](#) ( [Gane and Sarson 1977](#) ) [↗](#). I've spent much of my time since then trying to understand why it worked so well, and developing tools, constraints, and methods that helped with the challenges.

Fig. 1 Shows the set of symbols used in my combined material and data flow model. The rounded blue boxes are transformations of data or materials. The teal boxes are agents that are the sources or sinks of data or materials. The reddish-brown boxes store data or materials at rest. Each symbol is a node that is connected with other nodes via an edge. Combined, this, is called a graph. Besides color and node shape, dotted lines within the node represent data. Solid lines represent materials. As I explained in [AA](#) , data flow diagrams are behind agents that operate transforms. This is why I think it is OK to mix the nodes, as most of the function is behind the screens, the black box of the device or report that assists the transform. Magenta dots in the corner of a transform/process node mean the node can be expanded by clicking. An orange dot means that notes and narrative will show with a pointer hover. A blue dot in the lower right corner means there is a connection to the associated full data flow.




**Figure 1: Top**

# Operations

## Graphs

### Creating a Graph from Stack Graph Format

In [3sA](#) I wrote about the whiteboard technique to gather information collaboratively. I also wrote about how these ideas can be thought of as mind mapping, and even gave an example of how to export a mind map directly to triples.  introduced graph stack format. Let's use that to create the graph in Fig. [1](#).

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**Figure 2: T**

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