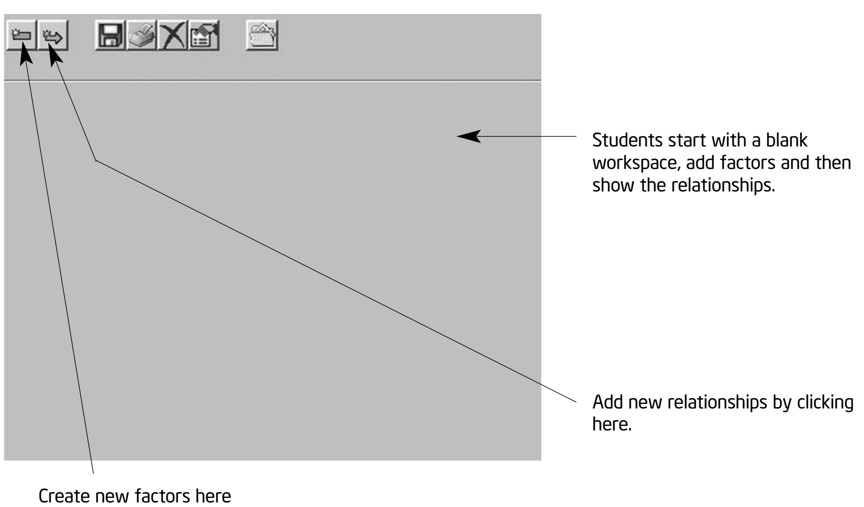
Walkthrough: A Seeing Reason Project Example

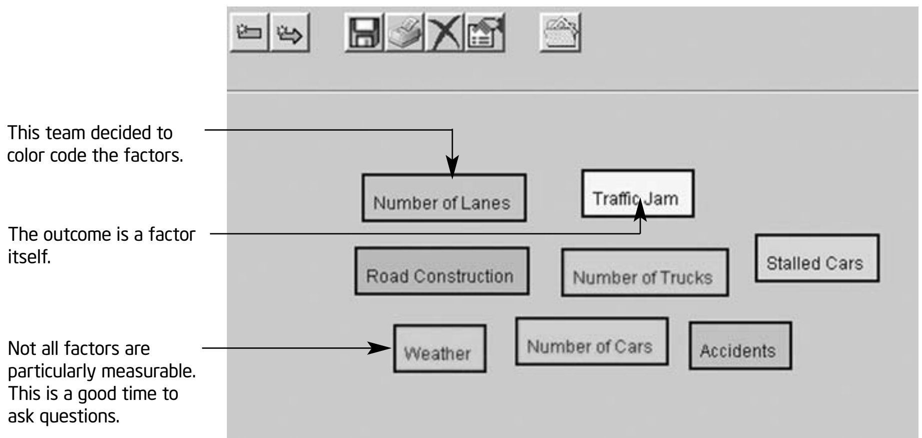
Helping students sort through complex relationships is what the *Seeing Reason* mapping tool does best. A good *Seeing Reason* project grows out of a real-world problem with complex relationships. For student investigations, it's usually best to frame a problem in the form of a question. For this classroom example, we will study the problem of traffic and investigate the question, *"How can we prevent traffic jams?"*

Everybody experiences traffic jams and everybody has seen at least one cause of them. The first step is to get the class to agree on a definition of the problem. What do we mean by traffic jam? (Do we mean stopped cars or just slow traffic? Do we mean highways or any kind of road?) A precise, operational definition is not necessary, just a good idea about the problem. A brief classroom discussion for agreement about the boundaries of the investigation is usually sufficient.

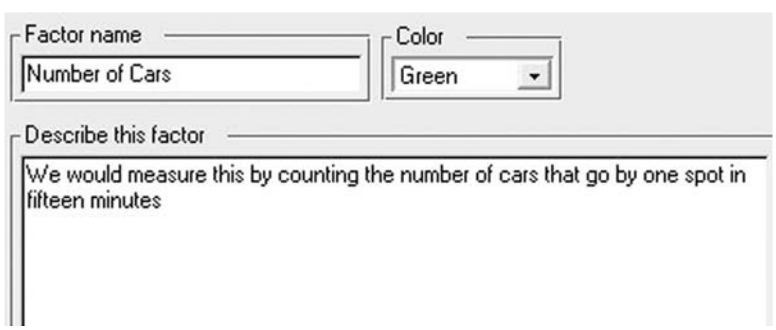
At this point students are ready to use the *Seeing Reason* mapping tool.



Working in teams at the computer, (teams of two work best for most problems), the students discuss and create the factors (or variables) that can cause traffic jams. They are using experience and intuition, drawing upon prior knowledge.



Students create factors on a map. They title the factor and describe it. A good description includes information on how to measure the factor or what evidence would indicate that an event has occurred. For example, the factor "number of cars" would have a description defining the number of cars passing per minute.

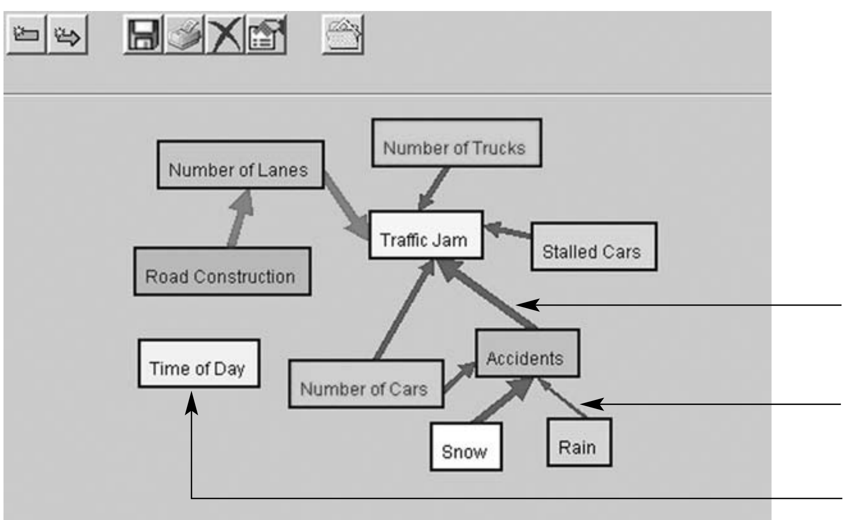


Initially there are not too many rules on what constitutes a factor, since there might be some interesting and unexpected thinking going on. This is where the teacher can really benefit from this "visible thinking." The teacher talks with the teams and asks probing questions such as:

- What do you mean by "weather"? Is sunny weather the same as rainy weather?
- How long does a car have to be stopped to be called a "stalled car"?
- Is there a reason that three of the factors are green?
- Does the position of the factors mean anything on your map?

Students' answers to these questions often belong in the descriptions of the factors.

As students identify factors, they often talk about how each factor is related to the problem. They now show those relationships on their maps by connecting factors with arrows. The relationships are entered in sentences with the form: "As A increases, B decreases/increases." For example, "As the number of cars increases, accidents increase."

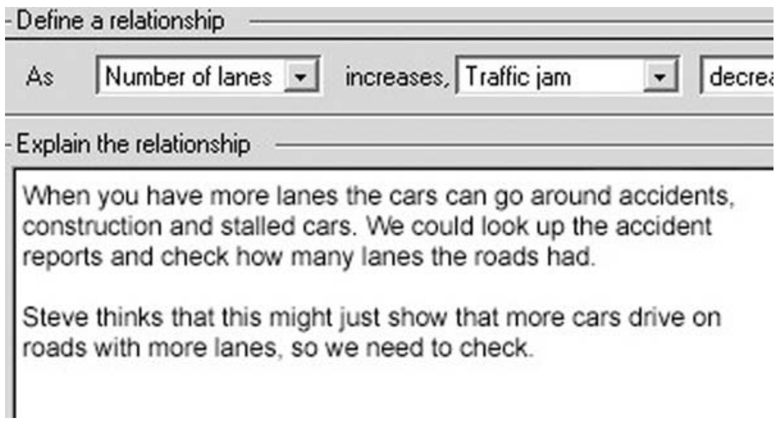


A thick arrow indicates that a factor increases or decreases "a lot."

A thin arrow indicates that a factor increases or decreases "a little."

This team wasn't ready to say how the time of day affects traffic jams but chose to leave it on the map while they investigate.

Sometimes when students try to put a factor into a relationship, they find a need to change their labels. (For example, "weather" doesn't cause accidents, "bad weather" does.) Students should be encouraged to change their factors if they need to. In this example, "weather" was divided into two factors, "snow" and "rain." When the teams enter their relationships, they describe how the relationship works and what evidence would prove whether the relationship is valid.

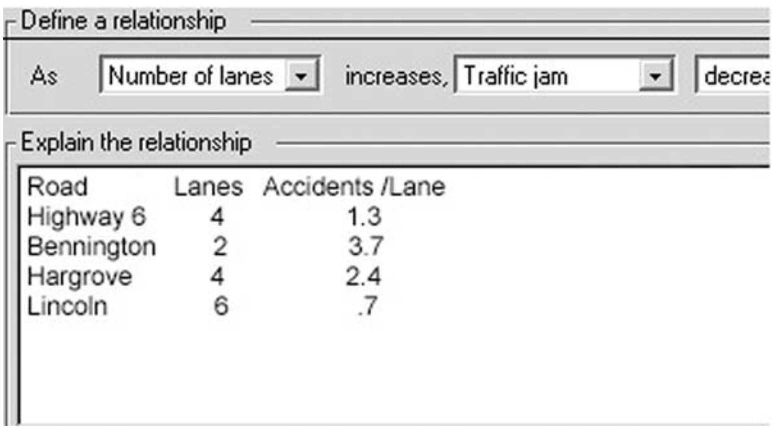


Student teams are always interacting with each other and with the teacher. They should agree on what evidence would support a causal relationship and ways to collect that evidence. The teacher gets to interact too. Some questions that might come up here would be:

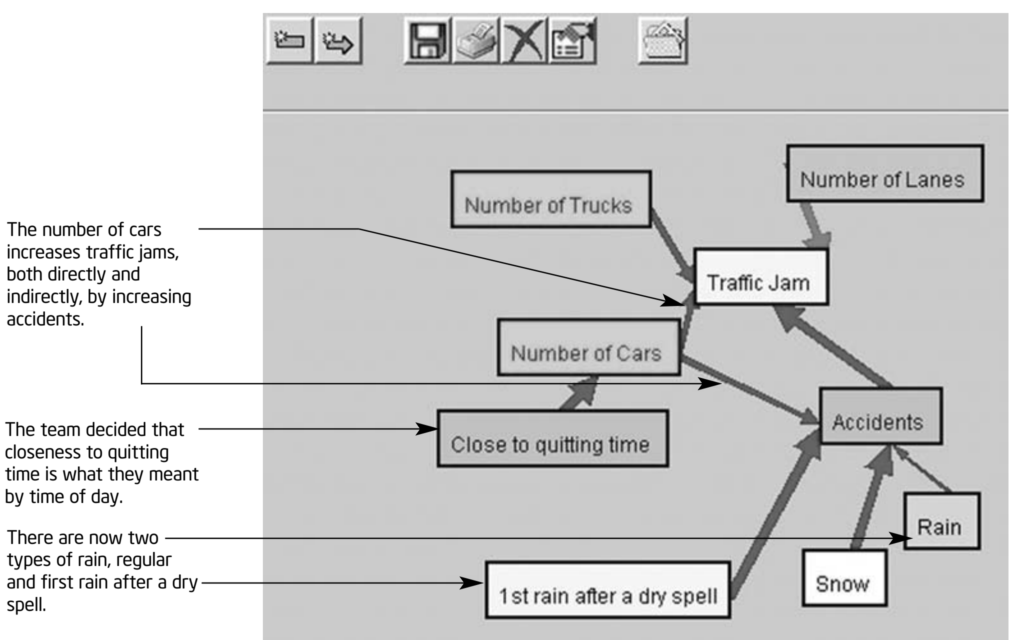
- Does an increase in road construction always decrease the number of lanes?
- Why do you think that increasing the number of trucks increases traffic jams less than increasing the number of cars does?
- Is there a way to word the "time of day" factor that would allow you to put it into a relationship? Why did you think it was a factor?

Once the teams have a map that shows their reasoning about a problem, they test their ideas. Depending on the investigation, they collect data, look up research, and make observations that will support their causal maps. In the current example, one team might start monitoring the local traffic from the sidewalk or on the Internet. Another team might go to the Internet to find out if there is research literature that supports their tentative relationship between the amount of snow and the number of accidents.

Armed with their data, the teams modify their maps to reflect their new knowledge and opinions. They enter their evidence into the description box for each relationship. It could be the actual data, references to the literature, or a record of observations. At this point the students are challenging each other to verify their reasoning. For each arrow on the map they should agree that they have sufficient evidence to support the relationship.

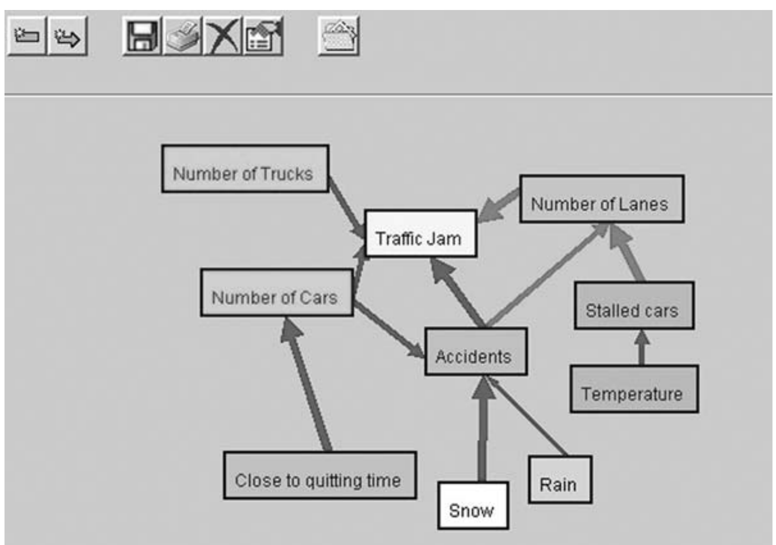


Some of the initial relationships may prove more complex than originally conceived. Students may refine initial relationships. The students in this example found that while increasing rain increases accidents, the first rain after a dry spell increases accidents a lot.



At this point the teacher might ask the students to print their maps and to write a reflection analyzing the critical factors that influence traffic jams.

In this project, students have used their maps and their research to study how traffic jams occur; now they must decide how to present them. They review their maps and outline solutions to present to their city council. Reviewing the map below, the team decides that they can have the greatest effect by addressing factors that increase or decrease traffic jams “a lot” (the relationships with the thickest lines on the map). Using this strategy, they find that “number of lanes” is the most critical factor. While their initial idea was to find a way to reduce the number of cars, their map shows them that the number of lanes available is a more critical factor than the number of cars traveling.



This map shows that there are three primary factors reducing the number of lanes. Red arrows point to “construction,” to “accidents,” and “stalled cars.”

Using their data, the team proposes the following programs:

1. Fund an incident response team of police and tow trucks to clear stalled cars and accidents as quickly as possible.
2. Put a bond measure before the voters to widen the highway by one lane in each direction and to build a breakdown lane beside the highway.
3. Investigate using a chemical agent to remove snow from the highway.

The team produces a set of tables and charts that demonstrate the influence of each of the factors on traffic flow. They predict the traffic flow improvements that result from their proposals and estimate the costs of each new program.

The teacher assesses the project based on the quality of the evidence gathered, the soundness of the recommendations, and the effectiveness of the presentation. The maps are not assessed as part of the team grade, but serve as a common reference point about causes of and solutions to the problem of traffic jams.

Notes: