**Introduction to Arrows: Sam Spade**

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| **Overall plan** | In this lesson students will act as members of a jury to determine if Sam Spade robbed a grocery store. In order to do this they will evaluate nine pieces of evidence. Students will pick between two different models, one model presented by the defense and one presented by the prosecution. | |
| **Driving question** | Is Sam Spade guilty? | |
| **Background and linkages** | This is a pre-activity before students start the cells unit. Students learn the following tools that they will be using throughout the rest of the year:  A. Arrows  B. MEL (Model-Evidence Link) diagrams and matrices.  C. Class norms | |
| **Content objectives and evaluation** | | NA |
| **Reasoning objectives and evaluation** | | Every subsequent unit will regularly use all the tools listed above. |
| **Quizzes and homework: Types of questions students should be able to answer.** | | |
| **Content:** | | NA |
| Content transfer | | NA |
| Reasoning w. content | | NA |
| Reasoning transfer | | Justify why you have chosen a particular arrow to link evidence with a model. |
| **Materials** | Student Packet, Overhead slides | |
| **Main activities** | **A. Introduce the Sam Spade problem.** Provide an overview of what students will be doing and learning. Explain the two models.  **B. Evidence 1.** Introduce students to Evidence 1 and to the arrows.  **C. Evidence 2.** Students first draw arrows and then individually write explanations. Then they discuss how Evidence 2 is related to the two models.  **D. Evidence 3 and 4.** With Evidence 3, remind students to use scientific language stems, and then practice with Evidence 4. Emphasize that they are accountable for giving reasons. The stems are intended to give them ideas of the kinds of things to say, if they run out of ideas, but they shouldn’t feel that they have to use just these stems.  **E. Arrow matrix and Evidence 5 and 6.** Next you introduce the table format for using the arrows, showing that if you put all the arrows together on a “regular” diagram, it becomes very messy, but it is easy to see all the relationships in the table format.  Students then do Evidence 5 and 6 individually—drawing arrows and writing two justifications.  After that, students discuss Evidence 5 and 6 in pairs, and then as a class.  **F. CURRENT IDEAS.** At this point, before getting the final piece of evidence, students write their current ideas individually. Finally you hold a class discussion.  **G. EVIDENCE 7.** Now the students evaluate the final piece of evidence and its implications in pairs. Students discuss Question 13 in pairs to discuss the implications of Evidence 7, and then answer Question 14 individually. You hold a final model comparison discussion as a class about which model is better, based on the evidence so far.  **H. Discussion Questions** | |

**Unit:** Introduction to Arrows: Sam Spade

**Main Idea:** Developing arguments based on evidence and how they relate to models.

**Lesson Timeline:** 2 Days Total

**Day 1:** – A-D (see below)

**Day 2:** – E-F (see below)

**Objectives:**

Students will be able to:

* Support claims with reasons in a scientific context
* Evaluate and respond to the science claims and reasons of others
* State how evidence relates to models

**Standards**

**CPI 5.1.8.D.1**: **Engage in multiple forms of discussion in order to process, make sense of, and learn from others’ ideas, observations, and experiences.** Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work.

**CPI: 5.1.8.D.2: Engage in productive scientific discussion practices during conversations with peers, both face-to-face and virtually, in the context of scientific investigations and model-building.** In order to determine which arguments and explanations are most persuasive, communities of learners work collaboratively to pose, refine, and evaluate questions, investigations, models, and theories (e.g., argumentation, representation, visualization, etc.).

**Assessment:** No assessment

**Materials:** PRACCIS Sam Spade Slides

**Do now:**

*Day 1* - Students read introduction to Sam Spade to themselves.

*Day 2* - #6 on page 6 of the student packet and show slide 3 of the powerpoint. Have the students think of ideas in preparation for class discussion.

**Closure:**

*Day 1* - D-4 **students why** asking for and giving reasons and discussing their areas of disagreement will help them understanding the evidence better and reach a better conclusion. Also ask students how the arrows can be useful in helping them think about models and evidence.

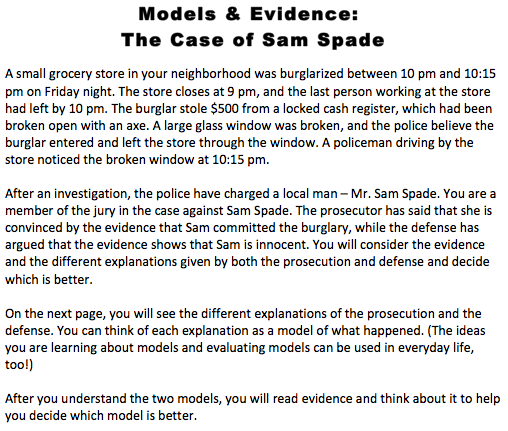
*Day 2* – Students write their final arguments on page 10, question number 14.

**Homework:** No Homework

**Modifications:** Planned by the teacher as it fits the needs of their particular students.

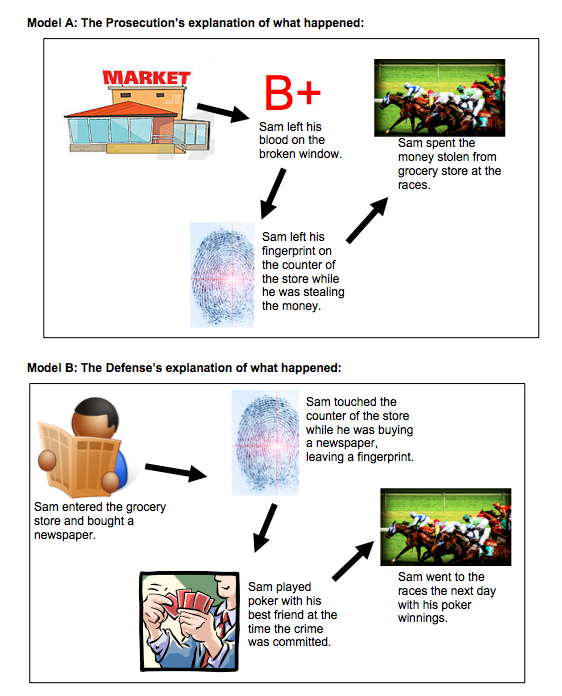
**Procedure:** More detailed instructions below.

**A. INTRODUCE SAM SPADE AND MODELS**

1. **Read Introduction of Sam Spade: Page 1.**

As a class, read through the introduction of Sam Spade. Students may read this silently, or take turns reading aloud. Or you might read it to them. Show PowerPoint slide #1.

**2. Framing.** Explain to students that they will act as jury members in the Sam Spade trial to determine if Sam Spade is guilty of robbing the grocery store. Explain that they will need to evaluate 9 different pieces of evidence to determine if Sam Spade really did commit the crime. Students will also learn about different arrows to help them think about how evidence is related to the two models.

**3. Introduce Models: Page 2**. Have students read through the two different models. Ask students to summarize the two models and ****point out the differences between the two. Show PowerPoint slide #2. This slide displays the two models and you can reference this slide throughout the activity as needed.

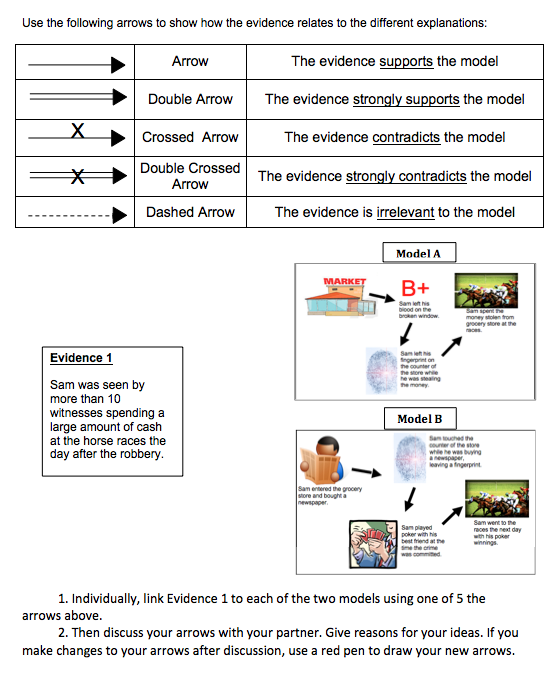
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**B. INTRODUCE EVIDENCE 1 AND ARROWS**

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**1. Class Discussion: Arrows.** Explain to Ss that we are going to use 5 arrows to show how the evidence is related to each of the models. Go through what each of the arrows mean.

**\* Strongly Supports –** Means that the evidence strongly supports the model. It has two lines super close together (a double arrow).

**\* Supports** – Means that the evidence supports the model, but not as strongly as if you use the “strongly supports” arrow.

**\* Strongly Contradicts** – Means that the evidence strongly contradicts the model. That means it goes against the model really strongly. It makes you think that the model really is not right.

**\* Contradicts** – Means that the evidence contradicts the model. That means it goes against the model, it makes you think the model is not right.

**\* Irrelevant** – Means that the evidence is not even relevant to the model. This means it does not have anything to do with the model.

**2. Framing:** Explain to Ss that they will be using these arrows to help them think about evidence and models.

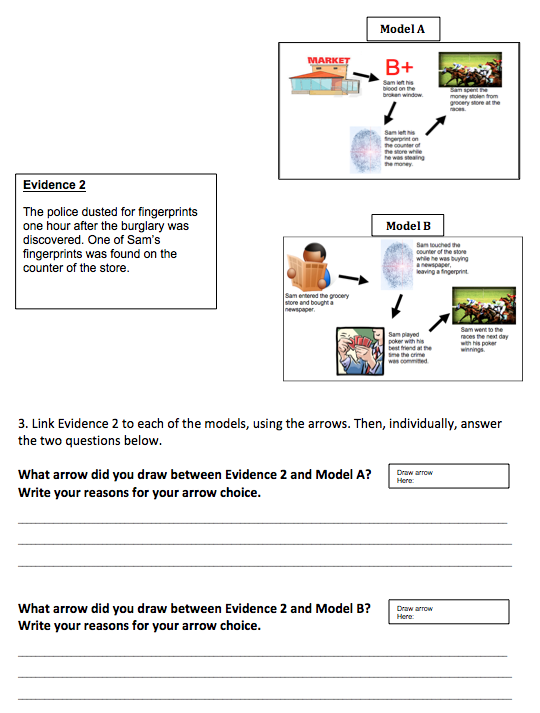
**3. Individual Work: Pages 3 and 4, #1, Link evidence 1 to each model.** Ss will read through evidence 1 and link it to each of the two models by using one of the five arrows. Make sure students circle their arrow choice in the question.

**4. Pair Work: Page 3, #2, Discussing arrows for Evidence 1**. Ss will then share their arrow choice with their partner. Ss should argue for why they picked the arrows they did and try to reach an agreement with their partner. Inform students that it is ok if their pairs do not reach an agreement if they are not persuaded.

GENERAL NOTE ABOUT ARROWS. Students may reasonably choose different arrows. Encourage students throughout to explain and argue for their choices, and please do not suggest that there are “correct” choices. The suggestions in evidence notes above are not “right” answers, and students may reasonably propose different arrows in many cases.

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**C. EVIDENCE 2**



1. **Individual Work: Page 4, #3, Link Evidence 2 to each model.** Ss read evidence 2 and link it to each of the two models by using one of the five arrows. Ss then justify their

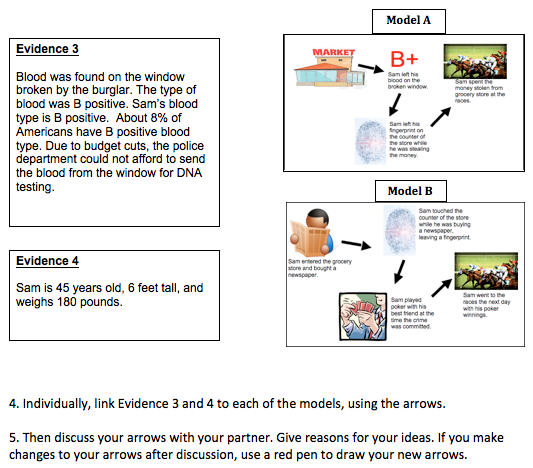
arrow choice relating evidence 2 to both Models A and B in the space provided. Make sure students circle their arrow choice in the questions and provide justification.

1. **Class Discussion: Arrows.** Discuss students’ arrow choices as a class.

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**D. EVIDENCE 3 and 4**

**1. Individual Work: Page 5, #4, Link Evidence 3 and 4 to each model.** Ss will read through evidence 3and 4 and link it to each of the two models by using one of the five arrows.

**2. Teacher explanation.** In a class discussion, remind students to use the **scientific language stems**. Emphasize that using these stems will help them think well about evidence and models and have rich, productive discussions that will help them understand models and evidence better and make good decisions about which model is better. Emphasize that they are accountable for using good reasoning talk. They can of course use other language of the same type, these are just examples of the kinds of things to say.

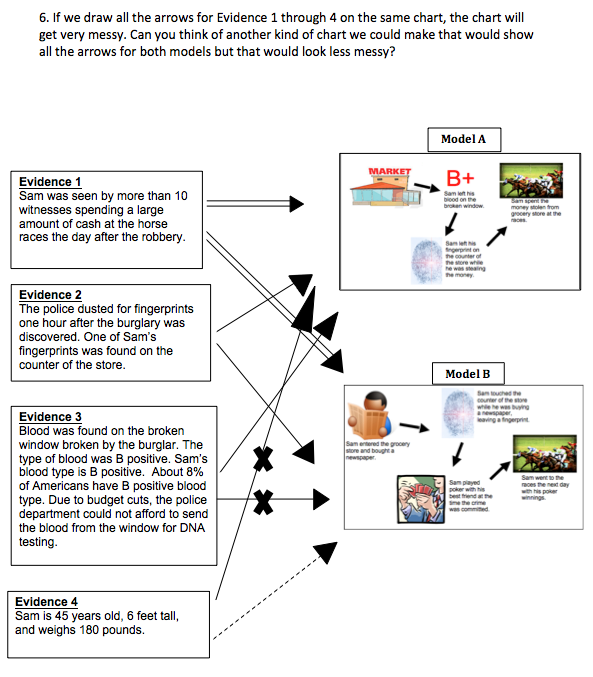
**3. Pair Work: Page 5, #5, Discussing arrows for Evidence 3 and 4, using their scientific language stems**. Ss then share their arrow choice with their partner. Ss ask for and give reasons while they discuss, and should express disagreement when they disagree.

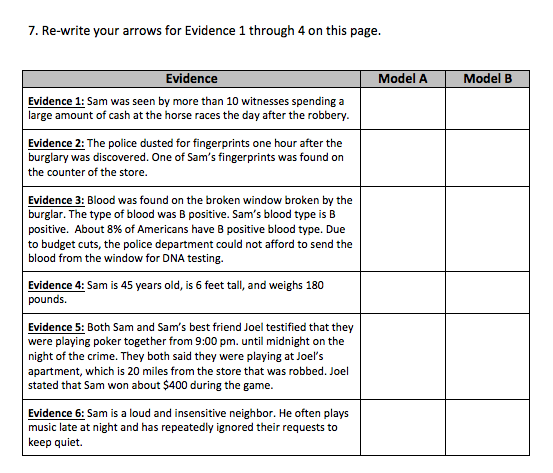
**4. Framing**. Explain that students have read through four pieces of evidence. They should start to think about how these four pieces of evidence will help them determine if Sam Spade committed the crime.

**Ask students why** asking for and giving reasons and discussing their areas of disagreement will help them understanding the evidence better and reach a better conclusion. Also ask students how the arrows can be useful in helping them think about models and evidence.

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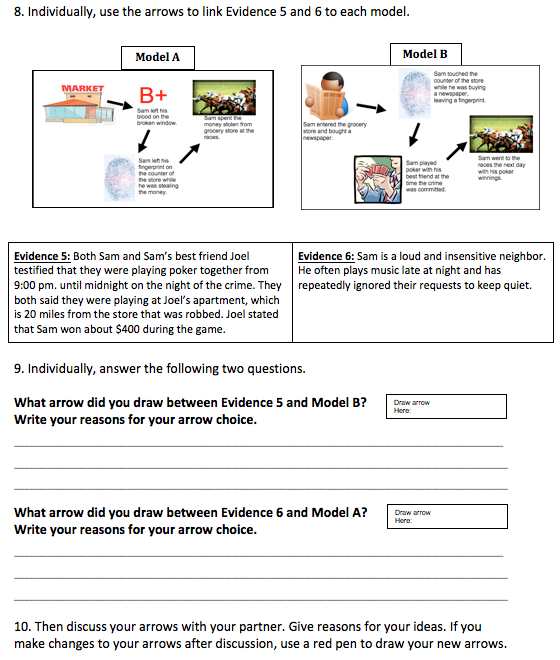
**E. ARROW MATRIX AND EVIDENCE5 & 6**

**1. Classroom Discussion: Page 6, #6, Arrow Matrix**. Show slide #3. This slide shows how messy the diagrams can get when you have multiple pieces of evidence. There is a place provided for students to see how messy it gets in their packet. Have students think of different ways this information can be displayed.

****Then introduce the arrow matrix (Page 7) for using the arrows, showing that if you put all the arrows together on a “regular” diagram, it becomes very messy, but it is easy to see all the relationships in the table format. You may want to demonstrate how to put the arrows into the table on the board.

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**2. Individual Work: Page 8, Link evidence 5-6 to each model.** Ss then read through evidence 5 and 6 and link it to each of the two models by using one of the five arrows.

**3. Individual Work: Page 8, #9, Justification of arrows**. Ss justify two of their arrows in the space provided. Make sure Ss circle their arrow choice in the questions and provide proper justification in the space provided.

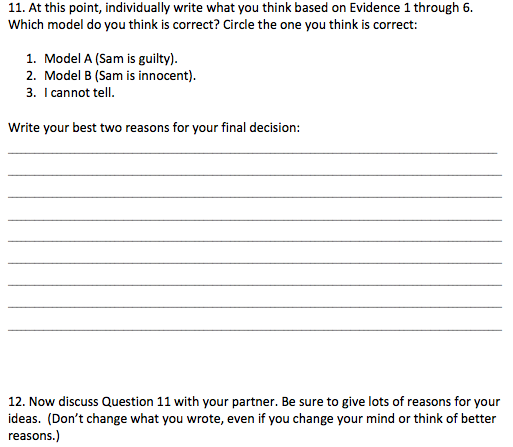
**4. Pair Work: Page 8, #10, Discussing arrows for Evidence 5-6**. Pairs should try and come to an agreement with regards to the arrows they picked, but do not have to if they are not persuaded by their partner.

**5. Classroom Discussion on arrow choices for Evidence 5-6**. Ss should share their arrow choices with the rest of the class. Ss argue for their arrow choice by giving many reasons for their choices.

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**F. CURRENT IDEAS**

**1. Individual Work: Page 9, #11, Selecting the better model**. Ask students to individually answer these questions in writing. Make sure they circle one model and then answer the other two questions.



**2. Pair Work: Page 9, #12, Discussing correct model, using scientific language stems to help them if they need it**. Ss then discuss their model choice with their partner, giving lots of reasons. Make sure the poster with scientific language stems is visible in the classroom for students to use. Pairs should try and come to an agreement with regards to which model is correct, but do not have to if they are not persuaded by their partner.

**3. Argumentative Class Discussion on which is the correct model:** Ss discuss their model choices. Ss argue for their model choice by giving many reasons and responding to each others’ reasons. SEE NEXT PAGE FOR DISCUSSION SUGGESTIONS.

You may refer to model goodness criteria, but model goodness criteria are not the main focus of this discussion.

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**Core questions:**

* **Which model is better? Model A that Sam is guilty, or Model B that Sam is innocent?**

**Don’t forget to give reasons.**

* **What do you think about Raj’s reason?**
* **Does any one agree/disagree with what Maria said?**

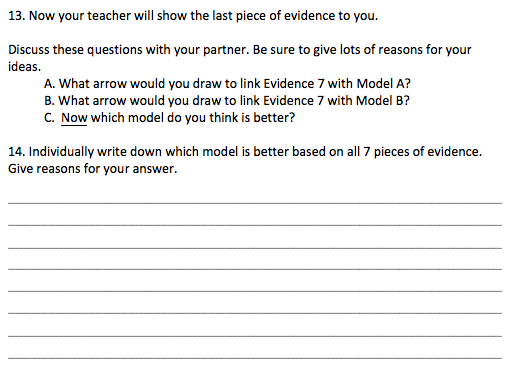
**Example of possible sub-question types.**

* **What do you think about Evidence 5? // What does Evidence 5 show?**
* **What do you think about Stephen’s answer/reasons/argument?**
* **Does anyone have a different idea?**
* **Who else has an idea?**
* **Which is the strongest evidence for Model A/B?**

***In general: Wait to see if students come up with key arguments before suggesting them yourself***

**If needed, remind students to ask for and give reasons, and to express any disagreements they have. Praise them for using language of reasons and disagreement if they are using it. “Remember, you can use lots of language to give reasons and to disagree with each other, like what we wrote on our poster.”**

**ALSO: SEE ADDITIONAL DISCUSSION NOTES AT THE END OF THE LESSON PLAN.**

**G. EVIDENCE 7**

**1. Individual Work: Page 10, Link evidence 7 to each model.** Show slide #4. This is evidence #7, the final piece of evidence, and it does not appear in the student packet. Have Ss read evidence 7, and link it to each of the two models by using one of the five arrows.

**2. Pair work: Page 10, #13, Discussing questions about Evidence 7.** In pairs students discuss questions relating Evidence 7 to Model A and B. They will then discuss which model is best based on this last piece of evidence. Ss do not have to write down the answers to these questions.

**3. Classroom Discussion on arrow choices and final models, after reading Evidence 7:** Ss discuss their arrow choices for evidence 7 to the rest of the class and their final model choice after seeing all the evidence. Ss argue for their arrow choice by giving many reasons for their choices.

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**ADDITIONAL DISCUSSION NOTES.**

Here are some additional notes about leading argumentative discussions in Sam Spade.

**1. Nipping crazy ideas in the bud.**

It is perfectly OK to say whatever you need to say to put an end to discussions about really off-the-wall hypotheses. For example:If students are suggesting that Sam Spade would hang around the store from 8:40 until almost 9 pm just to buy a newspaper, you can just say something like, “Here’s some additional information: everyone, including Sam, says he left the store after a few minutes.” Or you could say, “Let’s assume that Sam is like almost everyone else who visits a store just to buy one or two things; they just take a few minutes.” Don’t allow students to get hung up on unlikely hypotheticals.

Similarly: If students say that they might have found Sam’s fingerprints in other places but just didn’t tell us, you can say something like, “Let’s all assume that this evidence means that they dusted the WHOLE STORE for fingerprints and only found one that belonged to Sam, the one on the counter.”

**2. Explaining what “contradict” means.** If you would like to explain what “contradicts” means, here are some examples you might consider using.

“Contradict” means to show that something is wrong, or that it might be wrong.

Example 1. Joanne believes that it is bright and sunny outside. Then her friend enters her apartment sopping wet, carrying a very wet umbrella, dripping water everywhere. This is evidence that CONTRADICTS Joanne’s belief that it is bright and sunny outside.

Example 2. Aaron believes that dogs have 32 teeth like people do. Then his sister counts their dog’s teeth, and counts 42 teeth. This is evidence that Aaron is wrong. This evidence contradicts Aaron’s belief that dogs have 32 teeth.

Example 3. In her geography class today Catherine confidently stated that Africa is a country. Her brother, Paul, watched a documentary on Africa, which showed that Africa is a continent that consists of many different countries. The information on the television documentary contradicts what Catherine stated about Africa.

**3. What makes evidence “stronger.”** It may be helpful in these discussions and in later discussions to have some ideas about what makes evidence “stronger” so as to merit a double arrow. We are not suggesting that you try to teach these to students directly, but it may be helpful to you to have them in mind during discussions.

A. Consider Evidence 1, which says that 10 people saw Sam in the store. Suppose that Evidence 1 said that 1 person saw Sam. This would be less strong. This suggests that evidence is stronger when *more people agree*. More generally, it shows that evidence is stronger when *it is more accurate, or more trustworthy*. Also, Evidence 1 says that Sam was spending a large amount of cash at the horse races the day after the robbery. Suppose it said that that Sam spent just $3 at the horse races. This suggests that evidence is stronger when it *says exactly what the model says* or something like that.

C. Consider Evidence 2, which says that they found one of Sam’s fingerprints on the counter of the store. Suppose that Evidence 2 had said that they found 15 of Sam’s fingerprints on the counter of the store and also around the cash register. That evidence would be stronger. This suggests that evidence is stronger when it *strongly rules out the alternative* or something like that. (It rules out the alternative because if Sam were just a customer, he wouldn’t be touching the cash register).

This example also suggests that stronger evidence is evidence that *shows that the most important part of the model is right*.

**EVIDENCE NOTES:**

Students will receive this evidence one, two, or three pieces at a time.

For your information, this is the entire body of evidence presented during the trial:

1. Sam was seen by more than 10 witnesses spending a large amount of cash at the horse races the day after the robbery.

NOTES: This evidence supports both models. Both models stipulate that Sam went to the horse races to spend money the next day.

1. The police dusted for fingerprints one hour after the burglary was discovered. One of Sam’s fingerprints was found on the counter of the store.

NOTES: This evidence supports both models. Both models stipulate that Sam left a fingerprint on the counter.

1. Blood was found on the broken window broken by the burglar. The type of blood was B positive. Sam’s blood type is B positive. About 8% of Americans have B positive blood type. (Due to budget cuts, the police department could not afford to send the blood from the window for DNA testing).

NOTES: This evidence supports Model A, as blood matching Sam’s blood type was found on the broken window. Whether it strongly supports Model depends on what students think about how strongly having a blood type shared by 8% of the people implicates Sam. The evidence might be held to contradict Model B (not strongly); if Sam were innocent, his blood would not be found on the window, and the blood found on the window could possibly be Sam’s.

1. Sam is 45 years old, is 6 feet tall, and weighs 180 pounds.

NOTES: In our view, this is irrelevant to both models. (Students might argue, with a little plausibility, that the evidence mildly supports Model A, because he would be big enough to break the window. But since nearly all adults and many adolescents would be big enough to break a window, this is very, very weak support).

1. Both Sam and Sam’s best friend Joel testified that they were playing poker together from 10:30 p.m. until midnight on the night of the crime. They both said they were playing at Joel’s apartment, which is 20 miles from the store that was robbed. Joe stated that Sam won around $400 during the game.

NOTES: This evidence strongly supports Model B and contradicts Model A. If true, it rules out Model B because Sam could not be in two places at once, and so contradicts Model B. (Students may argue that it does not strongly support Model B because Sam and Joel might be lying).

1. Sam is a loud and insensitive neighbor. He often plays music late at night and has repeatedly ignored neighbors’ requests to keep quiet.

NOTES: This evidence appears to be irrelevant to both models.

1. The clerk at the grocery store remembers receiving an unusual $10 bill a few minutes before closing. The bill was unusual because someone had written on it with bright red ink, “Peter + Julia.” The police found a $10 bill in Sam’s wallet that had “Peter + Julia” written on it in bright red ink. The clerk said that the bill looks like the same one that he saw.

NOTES: This evidence strongly supports Model A and strongly contradicts Model B. It is very unlikely that Sam would have this $10 bill if he hadn’t stolen it from the store, unless he stayed in the store for nearly 20 minutes, until it closed, and then somehow received this bill as change. (This is possible, though not likely. And this seems a little inconsistent with Sam’s testimony).

GENERAL NOTE ABOUT ARROWS. Students may reasonably choose different arrow. Encourage students throughout to explain and argue for their choices, and please do not suggest that there are “correct” choices. The suggestions in evidence notes above are not “right” answers, and students may reasonably propose different arrows in many cases.

**SAM SPADE Argumentation Chart**

|  |  |  |
| --- | --- | --- |
|  | Overall pattern of evidence | |
| Model A | **Prosecution model is best:**  ● $10 bill found in Sam’s wallet matched the bill the clerk recevied right before the store closed the night of the robbery. This evidence is hard to explain away.  ● Blood found on the broken window matches Sam’s blood type. This is much less inclusive though. | **Defense model is best:**  ● Sam was in the grocery store during normal business hours buying a newspaper.  ● Sam’s friend Joel testified saying that Sam was at his house playing cards during the night of the robbery. |
|  | **Arrows** | |
| **Evidence 1: Race Track**  Supports Both Models A and B. Supports only because the evidence only talks about the location of Sam. | **Evidence 1 supports prosecution model (A).**  ● Prosecution claims that Sam was at the race track the day after the robbery.  ◄ But we do not know where Sam got the money he was gambling with.  ⌘ Perhaps not so strongly supportive because it does not rule out the defense model. Also, the prosecution is claiming that the money he used was the money from robbing the grocery store. The evidence does not directly show where Sam got his money.  **Evidence 2 supports defense model (B).**  ● Defense also claims that Sam was at the race track the day after the robbery.  ◄ But we do not know where Sam got the money he was gambling with.  ⌘ Perhaps not so strongly supportive because it does not rule out the prosecution model. Also, the evidence does not directly show where Sam got his money. | |
| **Evidence 2: Fingerprints**  Interesting because it supports both models. | **Evidence 2 supports prosecution model (A).**  ● Prosecution claims that Sam’s fingerprints were found on the counter. The fingerprints got there when Sam was robbing the grocery store.  ◄ Evidence does not rule out either model.  ⌘ Perhaps only supports the prosecution model. Would not be strongly supports because the fingerprints do indicate what Sam was doing at that time. Nor does it show WHEN Sam was in the store.  **Evidence 2 supports defense model (B).**  ● Defense claims that Sam’s fingerprints were found on the counter. The fingerprints got there when Sam was buying a newspaper.  ◄ Evidence does not rule out either model.  ⌘ Perhaps only supports the prosecution model. Would not be strongly supports because the fingerprints do indicate what Sam was doing at that time. Nor does it show WHEN Sam was in the store. | |
| **Evidence 3: Blood Evidence**  This evidence supports (strongly) Model A and Irrelevant or Contadicts B. | **Evidence 3 supports prosecution model (A).**  ● Blood found on the broken window matches the blood type of Sam.  ◄ But what about the DNA? We only know that the blood types match, still does not indicate that  the blood was same. There are many other people who could have the same blood type.  ❖But 92% people do NOT have that blood type.  ⌘ Perhaps only supports the prosecution model (not strongly). Students may argue that it strongly supports Model A based on the percentage stated in the evidence. It is a relatively rare blood type.  **Evidence 3 contradicts defense model (B).**  ● If Sam were innocent, his blood would not be found on the window, and the blood found on the window could possibly be Sam’s.  ◄ Maybe the defense did not include blood in their model because they knew it was Sam’s blood.  ⌘ Perhaps only contradictive (not strongly) because there are many other people who have B+ blood, even though it is a minority of people. Students might also argue that the evidence is irrelevant to Model B because the defense does not mention anything about blood in their model. | |
| **Evidence 4: Description of Sam**  This is irrelevant evidence to both models. | **Evidence 4 irrelevant to prosecution model (A).**  ● The prosecution provides a model of what Sam was doing on the night of the robbery. No descriptive evidence of what Sam looks like is made in this model. So this seems irrelevant.  ⌘ Students might argue that it weakly supports Model A because he would need to be big enough to break into the window. But almost all adults and adolescents are big enough to break in.  **Evidence 4 irrelevant defense model (B).**  ● Defense provides a model of what Sam was doing on the night of the robbery. No descriptive evidence of what Sam looks like is made in the model. | |
| **Evidence 5: Poker Game**  This contradicts Model A and strongly supports Model B. Good evidence. | **Evidence 5 contradicts prosecution model (A).**  ● The prosecution does not indicate that Sam was playing poker with his friends during the night of the robbery.  ◄ What if Joel is lying? What if Sam robbed the store and then went to go play poker with Joel?  ⌘ This evidence seems to contradict the prosecution model. The prosecution model does not talk about Sam playing cards with his friends at any point of their explanation of what happened. And it gives a good alternative way that Sam got money for the horse races.  **Evidence 5 strongly supports defense model (B).**  ● The defense claims that Sam was indeed at this friend’s house playing poker the night the robbery happened.  ◄ What if Joel is lying? If true, it rules out Model B because Sam could not have been in two place at once, and so contradicts Model A. Students may argue that it does not strongly support Model B because Sam and Joel are lying. | |
| **Evidence 6: Music**  This is irrelevant to both models. | **Evidence 6 irrelevant to prosecution model (A).**  ● In the prosecution model, they do not indicate that Sam was at home during the night playing his music.  **Evidence 6 irrelevant to defense model (B).**  ● In the defense model, they do not indicate that Sam was at home during the night playing his music. | |
| **Evidence 7: Music**  This evidence helps students to determine which model is in fact correct. It strongly supports Model A and strongly contradicts Model B. | **Evidence 7 strongly supports prosecution model (A).**  ● The only possible way for Sam to have gotten this $10 bill is if he robbed the store. This is the concluding piece of evidence in which students will now be able to make a final conclusion that Model A is correct. Students may be able to eliminate Model B now.  ◄ A possible counterargument is that the clerk misremembered when he got the bill. If he had received the bill at 8:40 or earlier, then he could have given Sam the bill as change.  ⌘ This evidence strongly supports the defense model. It is very unlikely that Sam would have this Sam $10 bill if he hadn’t stolen it from the store, unless he stayed in the store for nearly 20 minutes, until it closed, and then somehow received this bill as change.  **Evidence 7 strongly contradicts defense model (B).**  ● The defense claim Sam was in the store in the morning to buy a newspaper, however the bill Sam received was a bill the clerk received at the end of the day.  ⌘ This evidence strongly contradicts the defense model. Students may now be willing to eliminate this model as the correct model based on this evidence. | |