

## Argument Mapping and Analysis of Competing Hypotheses

Argument mapping and Analysis of Competing Hypotheses are different and *complementary* analytical frameworks.

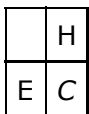
This page introduces both AM and ACH in juxtaposition with each other. Note that the discussion focuses on the diagramming techniques which are at the heart of, and the most visible manifestations of, their respective approaches. In both cases, these techniques come wrapped in distinctive methodologies or processes for thinking one's way through complex reasoning.

Consider the simplest case, of a single piece of evidence providing support for a single proposition. AM and ACH use different terms to describe this situation:

	ACH	AM
Evidence	Evidence, E	Reason, R, or Objection, O
Proposition	Hypothesis, H	Conclusion, C

They also use different conventions for "diagramming" this situation:

### ACH



### AM

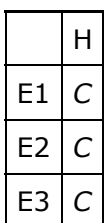


ACH uses a symbol (often C, for consistent) to indicate that E supports H; AM, in the most simple form, represents this relationship with an arrow.

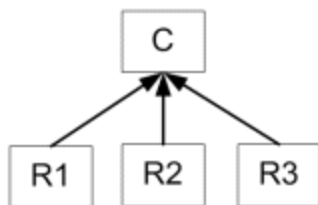
### Multiple pieces of evidence

Both frameworks can represent multiple pieces of evidence in relation to the same proposition:

### ACH



### AM



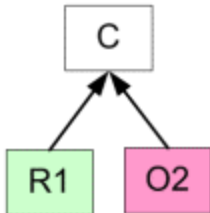
### "Polarity" of Evidence

What if an item of evidence doesn't actually support the proposition? What if it goes against the proposition? or is just neutral or irrelevant?

ACH handles these possibilities by changing the symbol specifying the relation between E and H. Thus, if E2 is evidence against H, and E3 is neutral or irrelevant:

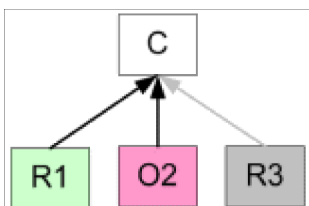
	H
E1	C
E2	I
E3	N

Argument mapping designates supporting evidence as *Reasons*, and opposing evidence as *Objections*. It also specifies this difference - what we call *polarity* - by using diagramming conventions such as the use of green for reasons and red for objections:



The case of neutral or irrelevant evidence in argument mapping is interesting. Often it is simply left off the diagram altogether, as in the diagram just above.

Sometimes, however, a piece of evidence has been presented by somebody as evidence for the conclusion (or evidence against it) even though it is actually neutral. Argument mapping handles this by including it on the map, but by using conventions to indicate its "worthlessness" as evidence, such as using the colour gray:



Thus argument mapping incorporates a distinction between *representing* the arguments, on one hand, and *evaluating* the arguments, on the other.

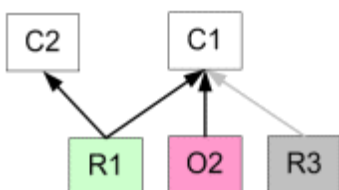
### Multiple Hypotheses or Conclusions

A single item of evidence can support or oppose a number of different propositions. ACH handles this by simply extending the matrix out:

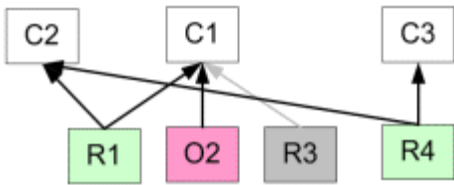
ACH

	H1	H2
E	C	I

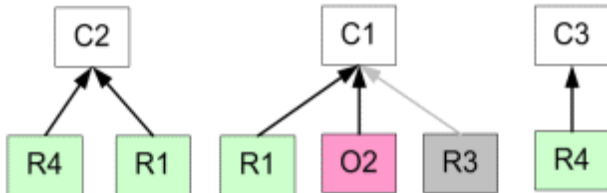
For AM, this is a bit awkward. An obvious idea is just to have two arrows from R1:



The problem is that when things get more complicated, with various items of evidence each supporting or opposing multiple conclusions, there is no way to produce a two-dimensional "box and arrow" diagram without ugly line crossings:



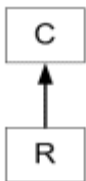
For this reason, most argument mapping uses a strictly hierarchical approach; argument maps are basically just "trees". When one item of evidence supports or opposes multiple conclusions, the item is duplicated, and if necessary, multiple trees are created:



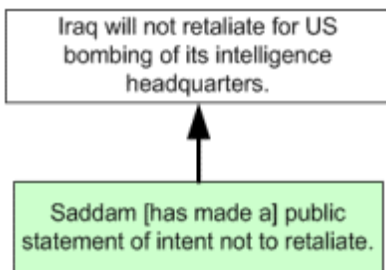
This is obviously rather inefficient, compared with ACH's compact matrix approach. It might seem, on this basis, that ACH is inherently superior. However, there are other considerations which tend to favour argument mapping rather than ACH. In particular, argument mapping's inability to compactly represent multiple "upward" inferences on one map is mirrored, in ACH, by a similar inability to represent multiple "downward" levels.

### Layers of Evidence

Consider again the simplest case of argument mapping:

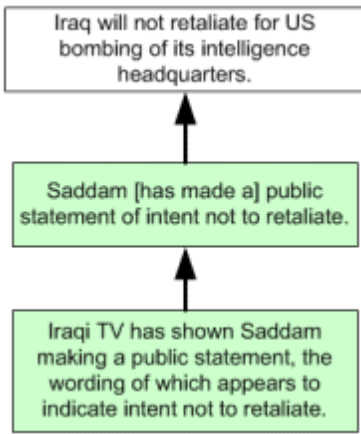


Fleshing this out, using an example from Psychology of Intelligence Analysis:



Notice that the reason, *Saddam [has made a] public statement of intent not to retaliate*, is a proposition which may or may not be true. In this particular case, it may in fact be true and uncontroversial. Often, however, the evidence for or against our primary conclusions or hypotheses consists of propositions which must themselves be established with evidence.

Argument mapping handles this by introducing boxes at another level:



[The second level evidence here has been made up just for the purposes of illustration.]

ACH, by contrast, cannot handle this kind of structure, at least within a single ACH matrix. Just as argument mapping had to introduce multiple argument trees to handle multiple conclusions, so ACH has to introduce multiple matrices to handle multiple levels of evidence:

**Top level**

	Iraq will not retaliate	...
Saddam public statement of intent not to retaliate	C	...
...	...	...

**Second level**

	Saddam public statement of intent not to retaliate	...
Iraqi TV has shown Saddam making a public statement, the wording of which appears to indicate intent not to retaliate	C	...
...	...	...

Alternatively, the analyst could skip the intermediate level:

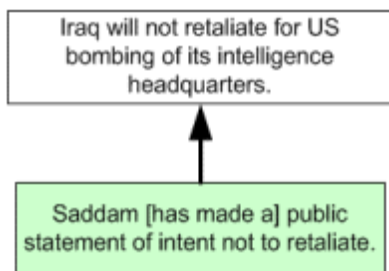
	Iraq will not retaliate	...
Iraqi TV has shown Saddam making a public statement, the wording of which appears to indicate intent not to retaliate	C	...
...	...	...

Like a bump in the rug, however, the problem is not removed, just moved. On this approach, every lower-level piece of evidence for or against the proposition that *Saddam has made a public statement of intent not to retaliate* will need to go into the matrix. Instead of multiple matrices, we would have a blowout in the size of the main matrix - and we would have lost sight of the significance of these more detailed pieces of evidence, and their natural groupings.

This discussion is pointing towards a major issue in the ACH method: the *granularity* at which evidence is expressed, for the purpose of entering it into an ACH method. Argument mapping handles this challenge by allowing evidence at multiple levels of granularity on the same argument map; indeed, a rule of good argument mapping is the principle of abstraction: *the higher the level on map, the more general or abstract the reason or objection.*

## "Assumptions" or Warrants

Consider again the simple inference:



Saddam's making a public statement of intent not to retaliate only supports the idea that Iraq will not retaliate if at least the following are true:

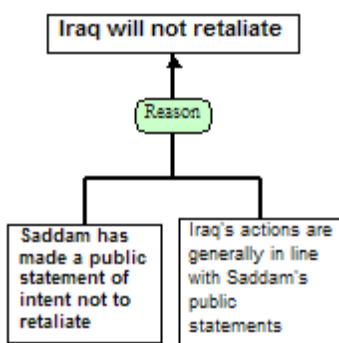
- Saddam generally stands by his public statements.
- Saddam has the power to determine what Iraq will do.

or, more simply:

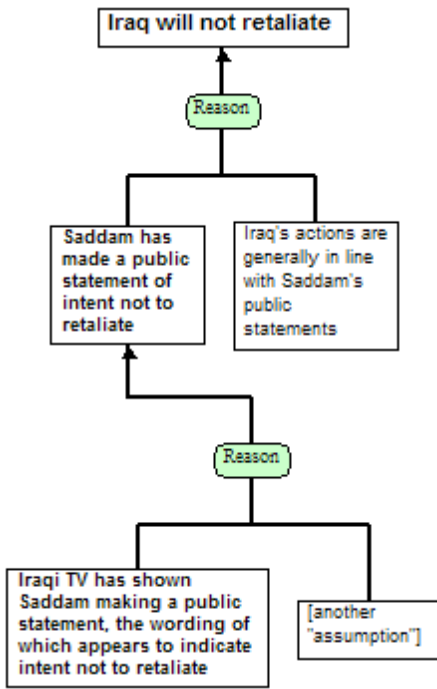
Iraq's actions are generally in line with Saddam's public statements.

Philosophers and argument mappers would usually use the term *assumption* for this other proposition, previously unstated, on which the inference depends. However, the term *assumption* has an established and somewhat different usage in intelligence practice, and so here I will use the term *warrant* instead (following Stephen Toulmin and his famous argument diagramming approach).

In argument mapping, warrants are represented directly on the map. There are various ways to do this; in the Reason!Able software, they appear as follows:



These warrants are present (though often hidden) for every inference at every level. Thus, in fully articulated argument maps, all reasons and objections have their warrants displayed:



The standard ACH method, using a simple matrix, does not handle this sort of structure easily. Consider the basic case:

	Iraq will not retaliate
Saddam public statement of intent not to retaliate	C

Where does the warrant go? Not as a separate item of evidence:

	Iraq will not retaliate
Saddam public statement of intent not to retaliate	C
Iraq's actions are generally in line with Saddam's public statements.	C

For this fails to show that it is the *two statements together* that are consistent with Iraq not retaliating, not either of them on their own.

Another approach would be treat the warrant as justifying treating the evidence as consistent with the hypothesis:

	Iraq will not retaliate
Saddam public statement of intent not to retaliate	<i>C, because Iraq's actions are generally in line with Saddam's public statements.</i>

or to bundle the evidence and the warrant together:

	Iraq will not retaliate
Saddam public statement of intent not to retaliate AND Iraq's actions are generally in line with Saddam's public statements.	C

Either way, the compact ACH matrix is becoming rather more unwieldy. It seems that usually, in practice, these warrants are not represented in the matrix. But that is just to say that usually, in practice, much of the "logic" of the case goes unarticulated and is to that extent invisible.