This next section I'm going to give you some tools or heuristics to allow you to see systems and be able to start thinking about creating a systems map. I'll talk a little bit about this notion of perspective and then I'll give you some tools to be able to think about mapping a system essentially as a static picture. Then I'm going to try and give you some tools to set that picture in motion and then think about some of the dynamics of complex adaptive system so that by the end, you'll be able to hopefully map a system that you're interested in changing so that you can understand how to start thinking about changing it.

I'm going to start with this notion of perspective. This is an example that I love to use. This is out of Mario Giampietro's book Multi-Scale Integrated Analysis of Agroecosystems. Don't be put off by the title. It's a really nice, clear, simple example. Mario is a systems thinker and ecological economist.

In the book he talks about this example of imagining that you're being requested to pick up a visiting scientist from the airport. You are given the name Dr. X, but we don't know his or her face. The most obvious additional input you need to perform this task is a picture of Dr. X.

Now imagine that we ask for a picture of Dr. X and we receive this, with a note saying, "*Please find enclosed the picture of Dr. X that you requested*." Obviously, this picture is useless for the task in hand in terms of picking up Dr. X from the airport. What this picture is is the result of an experimental microscope camera that allows us to see the inside, I believe, of Dr. X's duodenum and gives us very useful information of how Dr. X digest nutrients to keep him or herself alive. Really useful information in terms of being able to think about how nutrients work through the human body, but absolutely useless for the task in hand.

The next logical step is to ask for a larger scale picture of Dr. X and we received this: "*Fulfilling your request, please find enclosed a larger scale picture of Dr. X who was indicated by the arrow*." I've just drawn a red box around the arrow. This is a picture of Dr. X apparently at an Italian green party rally. It provides us some useful information in terms of social, economic, or political leanings that Dr. X might have; that he or she is likely left leaning in their political tendencies and probably interested in environmental policy and that kind of thing. Aside from telling us that Dr. X attended an Italian green party rally, absolutely useless for the task in hand.

Next, we're going to try to stem the flow of useless information here. This time we're going to specify the picture of Dr. X has to include the whole head and nothing but the head. We are fixing the scale of the picture as well as the boundary, and I'll get to those terms in a few minutes again, to hopefully avoid what Mario Giampietro talks about in terms of *non-equivalent representations*, which is what we've seen so far. Each one of these is a picture of Dr. X but at different scales, different boundaries, and with different mapping mechanisms. We're trying to fix all of those. I always imagine when I read this who that smart aleck is on the other end of this, who is the smart aleck providing these pictures of Dr. X; obviously imaginative, but kind of annoying.

Now we fix the scale and the boundary and saying we want the whole head and nothing but the head and we received this. In this way we see Dr. X's head but again virtually useless for the task in hand. If you have the right expertise—that is, if you're a physician and happen to know something about the ratios within a skull—you can discern that

this is likely a woman and that apparently Dr. X has a bit of a blocked sinus. Again, incredibly useful information. We've now narrowed it down to approximately 51% of the population and we can tell that Dr. X has a blocked sinus. Useful information, but absolutely useless for the task in hand.

Now we have fixed the scale and the boundary but, as Mario talks about, we need a different kind of *mapping mechanism* here. We would like visible light rays as opposed x-rays. Finally, once we clarify this, we finally received a picture of Dr. X that we can use to pick up Dr. X in the airport.

This simple and silly example just highlights the importance of perspective for me. As my former PhD adviser used to say, "*You cannot talk about a system without talking about who is looking at the system and why*," i.e. the importance of perspective and purpose when you're trying to describe a system.

Equally viable but non-equivalent representations that we just had there from Mario's book: a picture of a duodenum, a picture of Dr. X in an Italian Green Party rally, an x-ray of Dr. X's head, and finally, a visible light rays fixed on the head.

All useful for different purposes, but if we're picking up Dr. X from the airport, it is really important to fix the scale and the boundary and the mapping mechanism to allow us to do what we needed to do.

What systems thinking does is it makes explicit these kinds of assumptions of what the useful bits of information are, while they really depend on your perspective and your purpose. I really want to hammer that home and we'll come back to that again.