

Spring 2004

**Guidelines for second client meeting(s) and presentation.  
Rough Dynamic Hypotheses<sup>1</sup>**

1. **Purpose of second client meeting(s): Rough Hypotheses.** The goal for the second week of the standard method is to begin the causal looping process. **As before, please hand in hard copies of your overheads.**
2. **Dynamic Hypotheses.** Dynamic hypotheses are explanations (not solutions) for the reference modes. Dynamic hypotheses have two parts: A structure or process part and a behavior pattern part. Dynamic hypotheses are theories that such and such a structure (or process) *could* contribute to such and such a behavior pattern.

Ultimately you will be able to state your hypothesis as: This *loop* could contribute to this behavior pattern. But loop-form is not necessary this week. At this point you do not need to have perfect loops, or to know how the loops link together. Of course if you easily and quickly see a loop, don't hesitate to draw it *now* – but concentrate on verbal explanations of the reference modes and don't fret if the loops that must somehow underlie these explanations remain hidden from you this week.

Your goal is to be comprehensive. Try to get down on paper all the hypotheses that people currently can think of -- use words or diagrams as you see fit. You will probably have half a dozen or so hypotheses. Of course, additional hypotheses may emerge later in the study and some hypotheses that you come up with this week may modified or even discarded later.

3. **Refer to your reference mode(s).** The hypotheses should be theories of what could cause aspects of the behavior of the reference modes. For example, if the issue is time to market (see **Error! Reference source not found.**) you might have hypotheses like:
  - a) As we increased our user base, we got more and more suggestions for the next-generation product, so each new generation got more and more complicated. We think this is one of the processes causing the rise in time to market up until now.
  - b) As we became a richer company we could afford to hire more engineers. This created communication problems and lots of wasted and time-consuming effort. This is another process that can cause time to market to rise

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<sup>1</sup> Prepared by Jim Hines 1998. Revised February 1999. Revised June 1999. Revised February 2000. Revised October 2000. Revised February 2004

c) etc.

You would NOT have hypotheses like:

- × When our inventories increase, we cut back production too much, which leads us to have too little inventory.

Even though this last hypothesis may be causing real problems at the company, it is not related to your reference mode. That is, it does not cause increasing product development times. This is where you **REFER** to your reference modes to decide what is relevant and what is irrelevant to your project.

3. **Hypotheses of behavior.** Ultimately, you will convert these verbal explanations into loops. And the loops, when coupled with the reference modes, will be the “dynamic hypotheses” of your project.

The fact that we are calling these things “hypotheses” indicates that there is some uncertainty. Many people immediately jump to the conclusion that the what is uncertain is whether the loops

- a) exist in the real world, or
- b) are the *dominant* structures causing the reference modes

In fact, neither of these two uncertainties is of much interest in the standard method. The first is too trivial and the second is too hard to answer. Usually, no one will question the existence of any single link in a loop, and so the loop itself won't be in question. For example, in hypothesis 3.a) above, we would know for a fact that an increased user base does lead to more suggestions from customers; and we would know for a fact that more suggestions from customers leads our client to put more functionality into each generation. We would know that putting in more functionality increases the complexity of the product and we would know that an increase in complexity of the product causes longer development times. On the other hand, there may be a big question about whether this explanation is *dominant* in causing the reference mode – or whether the full set of explanations (loops) are necessary and sufficient to cause the reference modes. Unfortunately, answering these questions of dominance and importance are for the most part beyond what one can do with small policy-oriented models. Answering these questions (or trying to answer them) would require the big enchilada, or perhaps even better, experimenting with solutions in the real world..

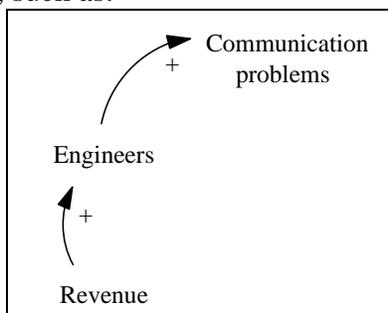
So what is the nature of the uncertainty that's relevant for small, policy-oriented modeling? The question of interest is whether the loops *can* generate the reference modes and, if so, under what conditions. What is uncertain is whether the loops (or verbal explanations) do tend to create the behavior patterns you think they do, and whether these are the *only* behavior patterns they can create. For example, the explanations in item 3 above are hypotheses because we are unsure whether they actually can lead to exponentially lengthening product development times or whether they might just as easily produce some other pattern of behavior. (Note: It often seems “obvious” that the behavior posited will follow from the loop; but trust me, surprises (i.e. “aha's”) happen).

Note that the standard method departs from other modeling traditions such as econometrics (and even departs from the way some SDers use modeling). In some modeling traditions, the model and its fit to data are used as *proof* that the structures *exist* or as proof that the structures are *important*. In these other modeling traditions structures often do not involve feedback or even non-linearity, so the behavior is not in doubt. In contrast, in the standard method, you and your client will already know that the structures (loops) exist; but, because they involve feedback and many inter-connections, you will not be sure whether the structures can generate the behavior you hypothesize for them. Later in the course you will evaluate your hypotheses about structure and behavior by modeling (some of) the loops and analyzing their behavior.

4. **Hypotheses should be comprehensive.** Listing variables is cheap and so your list of variables from last week should be comprehensive. Reference modes are also fairly cheap and so you might have thought that you should draw a reference mode for every variable. But in practice there are only a limited number of behavior patterns, so drawing modes for more than half a dozen or so variables is repetitive and wasteful.

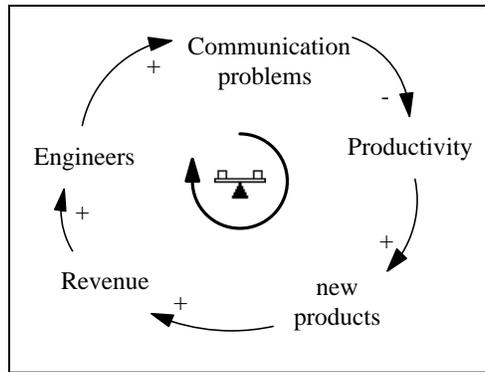
Now, *dynamic hypotheses* are not as cheap as variables, but they are still cheap relative to creating a computer simulation model. And, unlike reference modes, explanations tend not to be repetitive. Hence, you should be comprehensive with your hypotheses. Try to think of *all* of the structures, all the explanations, that could generate the reference modes. You will not have another chance to be comprehensive in this course – because simulation modeling is expensive, you will need to be quite selective in what you model. So, this is your time to be comprehensive – and the more comprehensive you and your client are, the greater the benefit to both of you.

5. **Rough Hypotheses.** At this point, go for rough hypotheses – don't worry if you do not immediately see a feedback loop. A *rough* hypothesis could be a simple statement as in hypotheses 3.a and 3.b above. For some or all of the statements you might have a partial loop, such as:



**Figure 1: A rough dynamic hypothesis in partial-loop form.**

Or, you might have some complete loops, such as:



**Figure 2: A dynamic hypothesis in complete loop form**

But don't worry if not all (or not any) of your hypotheses look like Figure 2. In your 3<sup>rd</sup> presentation, the following week, we will ask for nice complete loops, possibly all hooked together. **For this, the 2<sup>nd</sup> presentation, however, we are only looking for work in progress on all the hypotheses. Do the best you can.**

5. **Insights.** You should put effort this week and next into coming up with insights and policies from the loops, because you will NOT be revisiting ALL of your loops in the simulation phase (i.e. Some of your insights and policies may come ONLY from loops, so get them now while the looping is going on and is fresh in your mind).

Record insights and policies, and present them in your breakout session. For example, one insight from the loop immediately above (Figure 2) might be that the loop can cause a flattening or even a reduction in product development times. Flattening or reduction was labeled "hope" in the reference mode (**Error! Reference source not found.**). But, obviously, we don't hope that a flattening in communication problems and hence development times will occur because of problems with productivity and revenues. The insight here is that some undesirable processes can masquerade as good processes. Our client will want to carefully examine any future data showing flattening (or reduced) time-to-market to make sure it is not caused by undesirable processes.

Other sorts of insights may also come up. For example, you or your client might have an insight about system dynamics ("it lets us get out our ideas without animosity"). Whatever your insights are this week, collect them. They will never be easier to recall and describe than they are right now. The list of insights is a way of demonstrating to your client (and to yourself) that you are generating value. Ideally, the value you generate each week more than compensates your client for the time (and, if we were charging for our time, the money) your client spent on the project during that week. (Note this is the ideal, but you don't have to beat yourself up if you miss this ideal on some weeks).

6. **The client process.** You can get rough dynamic hypotheses in a meeting that includes many managers, or you may want to do a series of interviews of the managers you are working with. The latter approach may put less pressure on you and the managers.

If you go with interviews, plan on cycling through your contacts in sequence, spending half an hour to an hour with each interviewee. If you'd like, interview pairs of managers together. A pair works well if the managers like each other and are in overall agreement: The managers will work off each other, honing their explanations for you. In each subsequent interview with a new (pair of) manager(s), cover the explanations you have gathered to date. If you are on-site, taking over a conference room works well – have the interviewees cycle through the conference room. The growing lists and diagrams pasted to the walls will provide visual aids as you bring a new interviewee up to speed on what his predecessors had to say. Finally, if you go the interview route, plan on having a group meeting early the following week in which you will review all the explanations that came up. (Remember, the earlier interviewees will not have seen the full set of explanations).

**Note how wonderful this process is already.** One of the wonderful things about system dynamics is that it slows down the judgment process. The first week was only focused on problem definition (and solutions that are currently in the air), not on explanations. Ideally the second week (and the next) will be focused only on explanations, not problem definition or new solutions. Ideally solutions come mostly after the dynamic hypotheses are established. At this early stage, you need to make sure that the client doesn't get caught up in coming up with *new* solutions or arguing about the merits of different options.

## Example slides

### Slide 1

Nynex: Momentum Policies

- ◆ Don't lay people off (Nynex)
- ◆ Grow faster than the penalties (Nynex)
- ◆ Reduce rates even more if service stays low (Customers, regulators)

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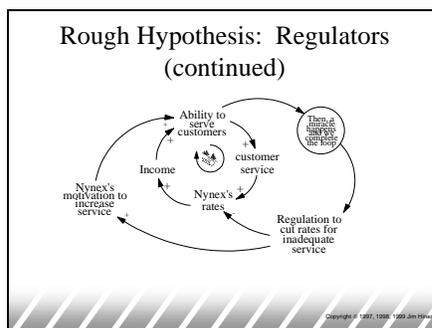
### Slide 2

Rough Hypotheses: Regulators

- ◆ By cutting the rates Nynex can charge, the regulators reduce Nynex's income making it harder for Nynex to serve customers well.
- ◆ Of course, the regulators *hope* that the threat of rate reductions will give Nynex the incentive to increase service.

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### Slide 3



Slide 4

### Rough Hypotheses: The Company

- ◆ The company is delaying laying off people so they will have more people to fix the problem.
- ◆ The company hopes that it will expand fast enough so that
  - the rate cuts do not mean lower revenues and profits
  - thus allowing the company to invest in service.

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Slide 5

### Rough Hypotheses: The Market

If service does not improve, Nynex will lose customers. With fewer customers, Nynex will be able to boost service.

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graph TD; Customers -- "+" --> Load[Load on the "system"]; Load -- "-" --> Service; Service -- "+" --> Customers;
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