**Critical Thinking Module Models Required**

Required Review Question #2: Explain one of your models and why it is the way that it is.

Required Review Question #3: What does dual system processing reveal about how you think?

Required Review Question #4: Tell me about one of your heuristics.

In this module you will:

1. Learn how we use models to translate the world into something that we can deal with.
2. Reflect on the emphasis that makes different models work.
3. Learn a new way to model your thinking.
4. Apply that model to your thinking.

This module gets a number of responses: it is obvious, obviously wrong, false, or true but uninteresting.  The last one is probably the most accurate. This content is true but not interesting on its own. What makes it interesting is how it is contrary to our existing systems and what the implications of that are.

A model is when we use one thing to represent something else.  A fashion model was historically supposed to represent how you look in clothes. A model airplane represents a real airplane. Both of these things have moved beyond their original modelling purposes, but they are referred to as models because one thing was supposed to represent something else. Take a second and think about how common models are and how much we use them. This writing models my voice, which is modelling my thoughts, which is modelling this idea of models. I model the weather based on a forecast, the forecast isn’t the weather, it is a model of the weather. This model is based on earlier weather patterns. We take the records of earlier weather patterns, which are themselves models, and create a model, then we look at current conditions and how they fit into the model and create a new model of what the weather will be today. When they had a problem with the space shuttle during the Apollo 13 mission (“Houston, we have a problem”), they could have tried to fix it based on theory of how the parts work (a theoretical model), instead they used a grounded space shuttle to simulate the problem and model their solution based on what they did to that shuttle (a physical model). Here’s the big point, models are everywhere. Every time we use one thing to understand something else we are using models. Every time we think about one thing in terms of something else we are using models. Every time we translate or convert something we are using models. Models and modelling is one of our most important and invisible skills. The fact that it is invisible is why it is so important for us to talk about. People don’t realize that we model, they pretend that we ‘understand’ things. The problem is that the word ‘understand’ hides the process.

The process is translation. When you take one thing and turn it into something else that is a form of translation. Translation includes converting one language to another. It also includes converting one thing to another. It also includes converting one thing to itself at a different time or in different circumstances. All models require translation because they all require us to understand one thing in terms of another. I want to make it clear how universal this is; all inferences require models, and thus translation, and almost all of our thinking is inferences. If you are getting this you will start to think that it is uninteresting, because by itself it is. If you are still thinking that it doesn’t make sense spend some more time on it. Any time we want to go beyond the direct information in front of us we need to start translating.

Here’s where it starts to get interesting. Translation is a product of emphasis. When you translate one thing into another you need to decide what to preserve. Poetry is a good example. When you translate poetry from one language to another you need to decide what parts to keep because a perfect translation is impossible. Do you preserve: The words? The rhymes? The pacing? The cultural implications? How about preserving the author? Anytime we translate we need to decide what parts need to be kept and what parts are expendable. Think about how you’ve translated things in your life, make a list of friends. Is your relationship with all of them the same? Probably not, because ‘friend’ can drop many details as long as it maintains that feeling of closeness. When shopping for a television people often reduce it to size and resolution. When hearing music we put it into a genre and often ignore all of the other details. Once you realize that inferences are a product of translation and translation is a product of emphasis then you can start to look at how you learn about the world in terms of emphasis. What information are you paying attention to as you read this? What are you emphasizing? What are you filtering out?

Here’s why this is such a big deal. All of our understanding of the outside world is modelling. Even a simple thing like a piece of chalk is too complex for us to understand. It has too many parts, too much history, too many forces interacting with it. It is also not the sort of thing that can go into our brain. Moving the chalk into your brain wouldn’t help you understand it. It might kill you, but you wouldn’t understand it. We need to translate the chalk into something we can get into our brain. When we do this we emphasize certain information (in this case: Do I need to write on anything? Will this mess up my clothes?). This is how we interact with the world, through translating it.

To complicate things further we use different models for the same things under different circumstances. We might use one model for a person if they are sitting next to us in a classroom but a completely different model if they are driving the car a little behind us and to the left. Physicists famously model light as both a particle and a wave depending on how we’re talking about it. We deploy multiple models based on our needs and we don’t mind if these models conflict with each other.

The whole purpose of this is to help you to understand the limits on human thinking so that you start to see the measures that we take to account for those limits.

**Dual System Processing**

The best source on this is Thinking Fast and Slow by Daniel Kahneman.

Let’s start with a question. You go shopping to buy a baseball bat and a baseball. The total cost is $1.10. The bat costs $1 more than the ball. How much is the ball? Answer quickly!

Most people answer $.10 or 10 cents. This makes sense. $1.10 - $1 = $.10. However it is wrong. More importantly it is a System 1 answer. The total cost is $1.10. The bat costs $1 more than the ball so if the ball is $.10 then the bat is $1.10 (it is $1 more than the ball) and the total of those is $1.20, not $1.10. Think it through, if the total cost is $1.10 and the bat is $1 more than the ball then the remaining $.10 needs to be evenly split between the ball and the bat. So how much does the ball cost? Half of $.10… $.05 or 5 cents. The bat is $1.05. The total is $1.10. The bat is $1 more than the ball. For most people this is a System 2 answer.

Dual system processing says that there is a detectable pattern in how our brains process information.  Sometimes we deal with information in a fast, low energy, and involuntary manner or System 1 type processing. Other times we deal with things in a slow, high energy, voluntary manner or System 2 type processing. Some examples of System 1 are identifying where a sound came from, figuring out which object is further away, or identify an angry facial expression. Some examples of System 2 are counting the number of the ‘a’s on this page, listening to single conversation is a crowded and noisy room, or doing your taxes.

To understand how System 1 is fast, think about how quick you realized that this word is written in CAPITALS. To understand how it is low energy, consider how easy it is for you to read. To consider how it is involuntary, try to not answer the following question: 2+3 =?

To understand how System 2 is slow, think about how long it would take make a list of all of your teachers. To think about it as high energy, think about how draining some parts of school are. To consider how it is voluntary, try not to answer the following question: 814\34.5=?

Learning how to drive is a great example. We all started driving in System 2. It was slow, we went through checklists in our heads (adjust the seat, adjust the mirrors, 10 and 2), it was tiring, it was voluntary. By now most of you probably don’t even need to think about it when you drive, it just kind of happens. You are likely in System 1 while driving most of the time.

This is not intended to be a comprehensive division. Things aren’t just System1 or System 2. There are variations within the Systems. However what is interesting is that there seems to be a general division between the two and most things generally seem to be one system or the other. Spend some time reflecting on whether your thinking is System 1 or 2. For now I’m going to continue with some insights granted by dual system processing.

Firstly, some surprising things are System 2. Have you ever walked at someone else’s pace? It’s tiring. Walking at someone else’s pace is System 2.  Walking at your own pace is System 1, it’s so easy that sometimes you don’t even realized that you are doing it. Other people’s paces are exhausting. This is true, not just of walking but of pace generally.  Classes are held at the teacher’s pace, which makes them exhausting for students. Children move at their own pace, which makes them exhausting for parents. There’s a lot you can learn by thinking about pace.

Monitoring yourself in social situations is System 2 and thus exhausting. Remember Thanksgiving with your extended family? That’s probably System 2 and probably exhausting. If that doesn’t work, consider a job interview. Monitoring your behavior is exhausting. Socializing can be exhausting. Forget the division between introvert and extrovert, this is far more informative.

The biggest insight that I like to draw from dual system processing is how important transitioning from System 2 to System 1 is.  System 2 seems like it is always better, but it isn’t. The important thing is the combination of System 1 and System 2. People pretend to always use System 2 but you are reading this using System 1. System 2 might be better at some things but fails at basic survival. If you see a car driving at you it is not worth your while to identify the make, model, year and license plate (usually System 2), just get out of the way (System 1).

One of the ways that we transition from System 1 to System 2 is through the use of heuristics. A heuristic is a shortcut to thinking. It is a procedure that takes a mentally challenging issue and offers an easier but imperfect path to answering it. When someone says, “how are you?” that’s actually a pretty tough question. But we deploy our heuristics and might say, “fine, and you?” without thinking too much. One of the things that dual system processing teaches us is that we move things from System 2 to System 1. Much of our life and our learning has been our brain trying to move things from System 2 to System 1 as an attempt to preserve energy. Think of it as your brain is always trying to take shortcuts. In many ways this is what we call ‘learning’. You come across something new, you take it in in exhausting detail but you learn what to ignore and develop shortcuts. Developing heuristics is only a part of learning. Another part, which is often ignored, is removing or improving heuristics.

Like all shortcuts, heuristics have strengths and weaknesses. A shortcut might force you to drive off road or over a toll bridge. A heuristic might allow you to skip checking a friend’s financials before giving them a loan or not check with the owner before petting a dog because of his waggy tail. Some of these work well, others not so much. Racism and sexism are caused by problematic heuristics. These heuristics are problematic because of the shortcuts that they use. These aren’t the only heuristics that use problematic shortcuts. Speed limits are based on the shortcut that exceeding a certain speed is unsafe. Safe speed changes based on the car, circumstances, and the driver, but we ignore all of those and just make a speed limit as a shortcut.

I could talk for a long time about heuristics but I’ve found the most valuable approach to them is to spend some time reflecting on them. Think about your habits. Think about the patterns of thinking you engage in. Spend some time doing it. Did you do it? Would you have done it if I used a paragraph break?

Or are you just keeping reading? In either case it is due to your heuristics. When you sit down in a classroom, where do your thoughts go? How about in front of a computer? One of the biggest challenges to learning is identifying and admitting your own heuristics. People would rather not admit that they have them because that admits weakness or the possibility of error. Consider the content covered in this course so far, which heuristics have you been using to understand it? What are the shortcuts they take? What are the strengths and weaknesses?

While heuristics are individual there are also patterns about them that people have detected. I want to talk a little about some patterns so you can get the most out of this course.

The first is that people prefer heuristics that provide them with solid answers. We don’t like heuristics that leave things unresolved. So rather than have a contextual answer, like ‘sometimes’ or ‘mostly’, we prefer heuristics that provide, ‘yes’ and ‘no’ or ‘never’. This often explains our approach to things. Even when we see things as unresolved, we like to have it in a resolved way. We say things like: ‘there is no right answer.’ It seems unresolved, but in a resolved way. Anything unresolved feels like a drain on energy, so we seek heuristics that conclusively resolve things. Unfortunately this causes problems.

One approach to justifying our heuristics is called ‘WYSIATI’ for ‘what you see is all there is’. When we are presented with a situation that should require System 2 thinking but we do not wish to expend energy on it we tell ourselves that we have enough information to make an educated decision on it. This is a key strategy for moving things from System 2 to System 1. If we identify a question that requires more information but we are unwilling to expend the energy, we tell ourselves that we don’t actually need more information. Who has the best pizza around? Answering that would require trying all of the places, but that seems like work, but most people think, ‘if they were good I would have tried them, so I can answer this without trying those places and thus save energy but still resolve things’. You like a movie that I do not? Should I investigate it and your reasons? That takes energy, instead I will assume you are wrong because that resolves the issue. Alternately, I can say ‘that’s your opinion’, resolving the issue with no energy on my part. I’m not saying it is bad to take these shortcuts or assume that you have enough information, but I am saying it is bad to do it and not realize you are doing it.

Another shortcut that we take is called attribute substitution or question switching. When we find a problematic question, we replace it with something easier. Do you like Japanese food? Rather than answer that question you might answer the question, ‘do you like sushi?’ There’s more to Japanese food than sushi. But switching the question to ‘sushi’ makes it easier. In fact, you might not even answer, ‘do you like sushi?’ you might answer, ‘do you have good memories of eating sushi?’ Rather than answer the difficult question, you replace it with an easier question, one that takes less energy.

Spend some time reflecting on your own thinking. When do you use System 1? How about System 2? How do you transition? How do you learn? What are the strengths and weaknesses of your heuristics? Do you need solid answers? Do you ever not seek extra information when you should? Do you switch questions?

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