Author's note regarding the preview chapter:

I've had feedback from a few people asking for more detail on "how" to implement the methods discussed here. The "how" is explored in more detail in other chapters of the book. I also included a few exercises here to provide some practice with that.

I've also had feedback that I don't make it clear enough that "marketing" is not about being deceitful, because I only mention that briefly in this chapter. In the book, the first two chapters go into more detail about what marketing is, and when it is used for good versus evil.

Addressing your audience's human needs

Every human has a basic set of needs, and your scientific work should always explicitly address one or more of these needs.

Your reader should always understand "what is in it for me?" If you don't help them understand that, then why would they want to spend time reading what you wrote? Or listening to you talk?

You may be asking yourself, "What does the reader need from me? How can I make my work fulfill those needs?"

Scientists are not the first people to face this challenge

Marketers have exactly the same challenge that you do. Whenever a marketer attempts to sell a product, she needs to define to the potential buyer how it will fulfill a need that the buyer has. If she can't convey that, the product doesn't sell.

If you are doing science, and want anyone in the world to care about your work, then you are doing the same thing as selling a product. Your product is your idea, which is placed in the scientific marketplace of ideas. It is a very crowded market, so buyers have lots of choices.

Why would they choose you? Because you convey to them how it fulfills one or more needs that they have.

An example from the world of marketing

Consider this marketing statement:

"BeyondWonder is the only pet rock you will ever need because it comes from the very best Chilean blue granite".

Would you buy such a pet rock based on this statement? Probably not, unless you have a lot of money to burn, and already have a thing for Chilean blue granite. Most people, however, will have no idea what Chilean blue granite is (since I made it up). This marketing statement will not fulfill anyone's needs.

However, if the statement is reformulated to address some human needs, it becomes more powerful:

"The BeyondWonder pet rock is made of the very best Chilean blue granite, which will help you achieve friendship and love. It will also help your plants grow better."

You still may not be rushing out to buy one, but hopefully you can at least see what needs of yours this might address. A marketer using this slogan for selling a pet rock is much more likely to sell at least a few, compared to the marketer who made no attempt to address any human needs.

Maslow's hierarchy

In fact, this concept of fulfilling human needs has been studied quite a bit. Abraham Maslow is considered a founder in this field. In his 1943 paper, A Theory of Human Motivation, he postulated a pyramid of needs (Figure 1). At the bottom of the pyramid are the most basic needs of physiology: food, water, air, etc.

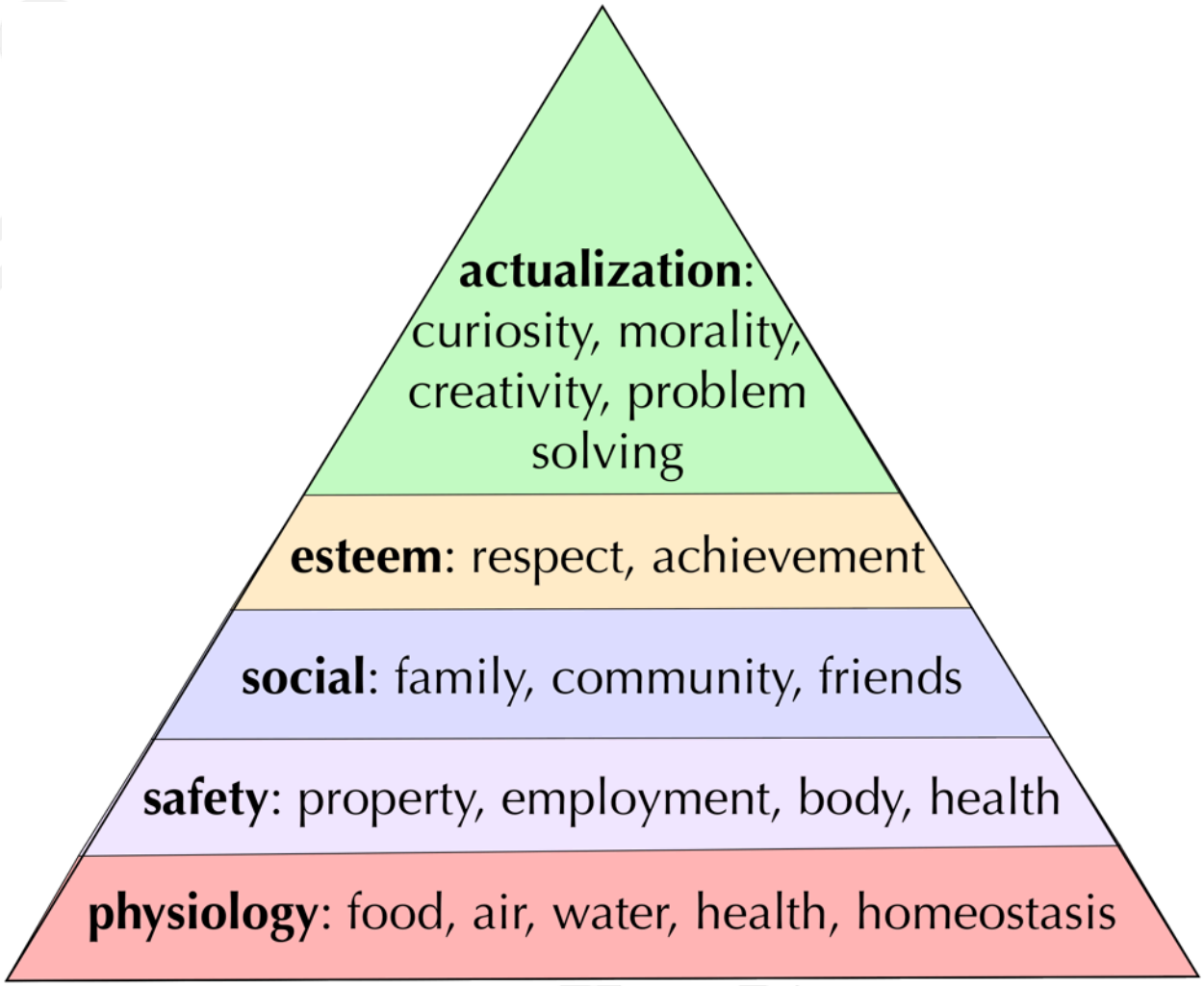

Figure 1: A paraphrased version of Maslow's hierarchy of needs (inspired by Wikipedia)

His theory is that once a lower level of needs is satisfied, a person moves up to the next level to seek fulfillment there. He arrived at this conclusion by studying exceptional people like Einstein and the very best performing college students, to figure out how they got there. He determined that a major component of moving up the pyramid was having the needs at the lower levels fulfilled.

While there have been some critics of his work who have advocated that there is no such pyramid, it seems pretty plain that there is some kind of hierarchy at play in the realm of needs fulfillment. Compare the ability of the typical third-world citizen to your own ability to self-actualize (the top level of the pyramid). Many people in the third world don't have clean water, access to enough food, and per-

haps not even shelter. Can such a person really spend time on scientific problem solving when he is starving?

If you don't have to worry about the lower levels, it frees your mind and your time to focus on higher level needs. Science clearly falls within the top level of the pyramid, under "problem solving" and "creativity."

Maslow's hierarchy is taught to marketing students. As illustrated by the example above, any marketing effort needs to show the audience how it will fulfill one or more needs, because a product that doesn't fulfill needs won't sell.

Your story tells how your "product" fulfills a need

The perception of needs fulfillment is all about how you convey your marketing story. That is just as true for science as it is selling a product. Please, ponder that before moving on.

Pet rocks were an actual product, that made their "inventor" Gary Dahl, millions. What did Gary invent, exactly?

He invented the story that a rock might be superior to a regular pet because it needed no food, water, walks, vet appointments, etc. He was able to convey that story to fulfill his buyer's perceived needs for friendship and self-esteem.

To one person a pet rock is just a rock. To the many buyers of pet rocks, it was far more. Which is it?

There is no such thing as objectivity when it comes to human psychology

While scientific training teaches us to be objective, when it comes to human psychology there is no such thing as objectivity. Everything is subjective.

And your scientific works, from papers to grant proposals to lectures will be interpreted subjectively, not objectively.

That is to say, it doesn't matter how rational, precise, deep, or smart you've been in your work. If your work does not attempt to address one or more needs of your audience, it will be very unlikely to have any impact whatsoever.

Let's consider an example. We are trying to do a study of the dark side of the moon. Let's say I'm writing a proposal for funding, and I start out like this:

"We are proposing to study the rock composition on the dark side of the moon. We want to determine whether the rocks have a composition that is similar to Chilean blue granite. Preliminary data show that the composition is unlike the earthly granite, but we believe it is important to confirm these results."

After reading that, did you have any feeling that you would derive benefit from this work? Would you vote to fund such work if you were reviewing this grant?

Note that this statement only conveyed the desires of the researchers proposing the work (to study moon rocks). It conveyed nothing about fulfilling any need of the reader.

How about if we rephrase it this way:

"A great mystery about the origin of the solid rock structures in our solar system is how and when they formed from solar gasses. We have preliminary evidence that the composition of rocks from the dark side of the moon can be studied to gain insight into solar origins from cosmic gas. In order to carry out this study, we are proposing to compare the chemical composition of dark-side solar rocks to Chilean blue granite, the most similar type of rock known on Earth."

Personally, I'd be far more interested in supporting the latter work. Why? It clearly tells me what needs of mine (as the reader) that it fulfills. First, there is curiosity fulfillment, about the origins of our solar system. Second, it may also have spill over effects into lower levels of the pyramid, because if we can figure out solar origins, it may help us secure additional resources to sustain human populations.

These two research statements were proposing to carry out nearly identical experimentation. Yet they would have dramatically different responses from an audience. That is because in the first statement, the author made no attempt to explain how the work fulfills a need. In the second statement, it is much clearer to the reader what need it fulfills.

Young scientists don't get any practice at this

Most young scientists I encounter are reluctant to do this kind of "needs fulfillment" in their papers and presentations. Many seem to think that every statement about a scientific topic should be dry and factual.

I am not sure why that is, but I have a guess. Maybe it is because they encountered over-zealous science lab instructors in their undergraduate years, that taught them to only report factual results of their assigned lab experiments.

I remember my days in science labs. Each week, we would receive some assignment to do an experiment, usually replicating some work that a long ago dead guy did. We had to take notes and do a lab write up.

But we never had to explain **why** we were doing the work. We never had to write about what need it fulfilled. Those things were pre-determined by the instructor for us in the assignment.

To get good at anything in life takes practice, and as my own example illustrates, most people don't get much practice at this when they're starting out in science.

"Just the facts" leads to dry and boring work

Dry and factual data - the kind expected in undergraduate lab reports - doesn't fulfill human needs. It is the interpretation of the data that **may** fulfill a need, if it is clearly linked by the author (you) to that need.

The facts may be highly interesting to you. But you shouldn't confuse your own interests with what your audience cares about with respect to their own needs. For example, I happen to be interested in whitewater kayaking. I know many facts about the subject, such as the exact meaning of the international rating scale of river/rapid difficulty, and those facts are highly interesting to me. But unless you're interested in the same subject, the very same facts would be absolutely meaningless to you, and hence you would consider them boring.

In other words, these facts fulfill my own needs (to explore new rivers, somewhere up there on the top levels of the pyramid), but they do nothing to fulfill your needs! Do not confuse those two things. In any scientific communication, it is all about your audience needs, not your own.

Hence, in any scientific work you produce, whether it is a talk, a paper, or a grant proposal, one of your very first goals is to identify what audience need(s) it fulfills, and figure out how to convey that to them. By addressing your audience's

needs, it becomes interesting to them. And therefore, they are far more likely to pay attention to you.

The lower on the pyramid, the easier needs are to convey

Generally, the lower a need falls on Maslow's hierarchy, the more important that need is going to be seen by an audience, and the easier it will be to get their attention.

For example, we might contrast our proposed research program in moon rocks to a research program aimed at eliminating malaria, which cripples and kills millions of people. While the moon rocks research fills a need mainly at the highest level (curiosity), the malaria research fills needs at the lower levels. How low it goes depends on how close you are to places where malaria is a widespread problem.

Maybe that's why the funding for health sciences research is so much larger than that for the physical sciences - because it is easier to convey the needs fulfillment in the health sciences, usually addressing a lower level of the pyramid.

I am not making a judgement about one avenue of research being "better" than another. I am just saying that with something like broad-impact health research, it is easier to address Maslow's hierarchy at a lower level, and hence convey needs fulfillment to a broader audience.

To illustrate this further, we can compare two areas of health research. See which one you'd be more interested in supporting or hearing about, and ask yourself why:

1. Research into a rare tropical disease transmitted by the Tse Tse fly, that kills a few hundred people per year and cripples many more.

2. Research into a virus that originated in pigs and is rapidly spreading across the globe, which may kill millions (including people you know).

If you picked number two, why did you pick it? I picked it because the virus being studied in number two is a potential threat to my own and my family's health, and so it is right there at the base of the pyramid.

Number one also fulfills a need, albeit at a much higher level - that of morality. In other words, once my basic needs are fulfilled, it is much easier to consider how I might help assure that other people have a decent life too. But there is a clear prioritization here in terms of the hierarchy. I doubt that many people will waver much from my own prioritization of these two in terms of my own needs.

The lesson from this is that the better you can target your research toward lower levels of the pyramid, the easier it is to convince a wider audience.

I'm not implying that you should drop everything and take up malaria or H1N1 research. There are plenty of people doing many types of research that address only needs at the highest level of the pyramid: primarily curiosity, morality, and problem solving. But those people working at the higher level of the pyramid have more work to do in conveying the needs fulfillment.

Conveying needs fulfillment depends on the audience

My lab has several research areas. One main focus is on using data from the analysis of proteins in cells to tell us more about how the human genome works. That may lead to better disease cures in the future. However, a smaller side research area we pursue is figuring out how bacteria become rapidly resistant to antibiotics.

When I'm out and about talking to regular people (not scientists) about what I do, I always tell them about the antibiotic work. It is easy to convey the needs fulfillment when it comes to fighting the development of drug-resistant "superbugs" that cause untreatable infections.

On the other hand, every time I've tried to tell someone about the genome work, I have received a quizzical look. It is harder to convey the value of that work to the general public, because it is higher on the pyramid (though it may have impact on lower levels in the future, a sort of trickle-down effect).

But if I go to a conference of genome researchers, I don't talk about my antibiotic work, I talk about the genome work. The audience is interested in the field of genome research, and wants to hear about developments in the area. I still have to pay attention to their needs to keep my work interesting to them, but I can do so in

a more focused way, and not concern myself as much with the lower levels of the pyramid.

Note that there is no subterfuge involved in which story I usually choose to tell. It doesn't have to be a case of "deceptive marketing" (which is, unfortunately, what many people think of when they hear the term "marketing"). It is simply a matter of choosing which story to tell, and when, based on who the audience is. This will be covered in the chapter on "There's always an audience, you just have to find them."

Use this in all of your scientific communication

This is the core principle of Marketing Your Science. If you do this consistently, every scientific communication you make will have far more impact than it would without. It can transform your writing and your presentations from ho-hum to top-notch.

You may be wondering how to do implement this. The principle sounds simple, but without practice, it is difficult to do for many people. Pay particular attention to Chapter 3: "Love your audience", and Chapter 4: "Value Proposition". Those chapters have the same core message, but provide you with concrete tools for implementing the concept.

Exercises

1. You are a grant reviewer for NOAA. You receive two proposals from competitors for developing the latest new weather modeling software. Here are the first few lines of the abstract from each. Which of these would you vote to fund, and why? Does the "why" have to do with the perceived value to you of the proposal?

Proposal A: "Johnson and colleagues showed that elliptical partial differential equations could be implemented to improve accuracy in complex weather models. They did a Lagrangian analysis that proved this to be the case. We are therefore implementing this approach into our weather model, WeatherPredictor 2, and as a result, it will be the best and most accurate weather model available. After implementation, we will test it with the Lagrangian analysis approach."

Proposal B: "Weather modeling is vital for the protection of human life and property, for predicting when major weather events will occur and implementing protective measures. Yet current weather models are deficient because they have a limited forecasting window of 3-4 days, and are only 70% accurate. We are developing a new elliptical partial differential equation-based solver for weather modeling that promises to improve both prediction accuracy and broaden the forecast window, allowing for more advanced implementation of protective measures for major events."

2. Compare the following opening lines from a CV for two theoretical candidates for a faculty job:

A: "I am the world's expert on the growth of corn in tropical countries. I know more about this subject than any of my colleagues, and I have a tremendous track record."

B: "Due to my expertise in the growth of corn in tropical countries, I can assist in your plans to expand your tropical agriculture program, to transform it into a world-renowned program that attracts top scholars and students."

If you wanted to hire someone to expand your tropical agriculture program, which candidate would you be more likely to want to interview? Which statement made the candidate's fulfillment of your department's needs more obvious?