

What I Said in the “Ice Cream Speech” at INFOCOM Plenary Panel 2010

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(The slides shared on my website are terse, and I’ve been asked to write down roughly what I said)

I’ve been asked to provide random remarks on something that I don’t know how to do myself: to do good research in the field of networking, especially in network theory. First of all, good theory shouldn’t break the bone next to your foot. But as you can see from the crutches here, I’ve been practicing bad theory. But they say those who can will do it, yet those who can’t can still talk about it. So there we go.

Now there’s no shortage of answers to this ill-conditioned questions already. Some say there’s nothing more practical than a good theory, which can be actually taken as a definition of ‘good’ theory. Some say good theory is like good jokes, I guess that means there’s an element of surprise and you giggle upon hearing it. Others say a good theory should have an impact, like used by 1 billion people or more, while the theory itself is interesting if not innovative in its own right. Here’s a partial list of famous examples in network theory getting to or close to that high bar. Some say it’s about cracking the hardest nails, others say it’s about welding the strongest hammers. You must have your own favorite ‘definitions’.

“Shall I compare thee to a summer’s day?” (It does feel like a summer’s day here today.) If “life is like a box of chocolate”, I wish good theory is like a stack of ice creams, on a waffle cone. You probably have no idea what I mean by that, me neither. Maybe the next four analogies are less non-sense.

Maybe good theory is like a pruner. It cuts the leaves, unifies the branches, and gets us down to the root of the tree of knowledge on a subject. It trims, rather than grows, a tree. Sometimes less is more. A paper that’s followed by hundreds of papers is often good theory, a paper that shows the past hundreds of papers are actually one paper is almost always good theory, so is a paper that terminates a string of thousands of papers.

Maybe good theory is like lenses that provide a useful view. It clarifies the dimensions and brings to focus the coordinates of engineering design. Some of us clearly relish the flavor of “proved” results. But even to those who don’t fancy this acquired taste, good theory does one thing remarkably well: it provides a language that is perhaps limited but definitely unambiguous. It sharpens the normal languages engineers use. You can disagree with the assumptions or the implications, but you’re speaking a language in which we’re clear what you’re disagreeing against.

Maybe good theory is like a crystallizer that keeps on running. To model is to crystallize engineering artifacts into a concise representation tractable today. It’s all about throwing parts of reality out of the window. The resulting theory, let’s assume it’s self-consistent, is therefore incomplete. Yet, once in a while, its predictive power is still there. My two year old daughter these days keeps asking me the question of ‘how come’: “how come this, how come that”. If she asks me “how come” on this magical power when you throw away just the right stuff, I’d have to say “I don’t know”. It remains a mystery to me. But we got to validate, or falsify, the predictive power, identifying and then bridging the theory-practice gaps along the way. This painful process is repeated nonstop in a good theory: completing again and again the loop with empirical data guiding the re-crystallization.

Maybe good theory is like a brain that listens to the heart. You probably have better experience, but I often sign in front of the gulf between theory and practice: what I can prove rigorously isn’t answering the first-order exponent question that I care, what I care most I can’t prove tight results or even have a quantified metric. But across that gulf we must go. Life is too short for trial and error based design for a complicated thing like networks. If theory-inspired design can help at the right spot, if we can rigorously answer the most relevant questions, that, to me, is good theory. And that’s hard. Some goodies are hard to get. There’re two ice cream shops in Princeton, one is quite a walk further away from my office. But the gelatos and sorbets there taste so much better. I have my group meeting there. It’s unbelievable taste. Now it’s way past lunch time on the East Coast, (and I can’t bear weight on my left foot), so let me stop right here.