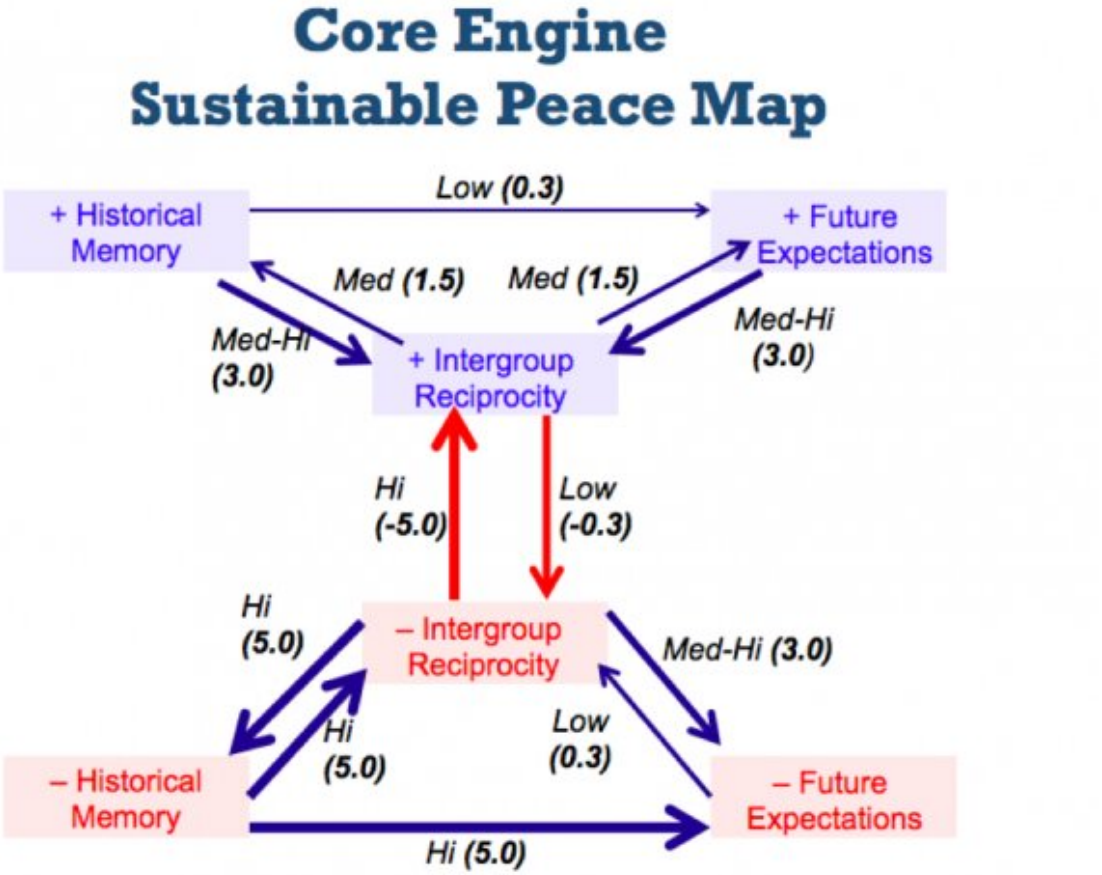
Q&A: What's math got to do with peace?

August 7 2020, by Allegra Chen-Carrel



Credit: Sustainable Peace Project

Larry Liebovitch is a professor in the Department of Physics and the Department of Psychology at Queens College, and at the Physics Program of the Graduate Center, City University of New York. He is

also a core faculty member of the Sustaining Peace Project at the Earth Institute's Advanced Consortium on Cooperation, Conflict, and Complexity (AC4). He recently developed a mathematical model simulation of sustainable peace in a society. In this mathematical model, users respond to a series of questions about a community by plugging in values for different factors that research suggests are important to sustaining peace. Examples of these factors include the degree to which leaders model peaceful values and the degree to which information flows freely between members of all groups in a society. The model then shows where the system of factors might end up over time—heading to war or situated in peace—offering a tool for the public to think about possible paths to sustaining peace.

The following Q&A has been edited for length and for clarity.

What was the purpose of the mathematical model that you created for the Sustaining Peace Project website?

In thinking through all the different factors that are important to sustaining peace in a community, we found that there are many things that interact with each other, so it can be very hard to think through all the details. For example, if a factor such as "good governance" interacts with a factor such as "equitable distribution of resources," and interacts with three more things, where does the whole system wind up?

One of the things you can do in a mathematical model is write down equations that represent all these interactions. Once you have equations, there are very standard methods to solve these equations. So, in a way, you just use these methods and then you can see where the whole system is going to wind up. So, the purpose was to see when we have all these interactions, if they're all happening simultaneously, what happens at the end? What values do all these different factors achieve due to the

influence of the other factors? In other words, how do all these pieces interact as a system to sustain peace?

The purpose of putting the math model on the web and GitHub was to provide people an opportunity to play with it. So they could say, 'Well, what happens if we increase the value of this variable (like tolerance education) or we increase the value of this interaction?' and see how that will affect levels of peacefulness in the community.

How can mathematical modeling contribute to the social sciences and policy making?

Social science systems are very complicated, and it becomes very difficult to think things through in terms of all the interactions. Even such a simple system as a family has a lot of complex interactions between parents and children and other relatives, and even trying to think through all of those connections can be quite difficult, so sometimes representing that by a mathematical model you can see things or where the system is going to go that you won't see otherwise. For example, with the mathematical model on sustaining peace, you can see whether or not a societal system might end up in a more or less peaceful place over time due to all these interactions between different factors.

In terms of policy making, it also means that you can run simulations. You can say, well, if I change this in the system (say, universal basic income), how will that change the whole system? It allows you to play with it, which also means if you make changes, and if those changes are made in the real world and they match the model, that would also give you greater confidence in the predictions provided by the model. So, it allows you both to understand what's happening within the systems, to test out different possible interventions, and to help compare the mathematical model with reality to verify it or see how it needs to be

improved.

What might some of the limitations of mathematical modeling be, especially when it comes to using it as a vehicle for understanding what leads to sustaining peace?

We're describing the interactions in this system, but there are pieces of those interactions that we don't fully understand. So, based on our experience with past problems, we have to guess the exact form of the mathematical relationships from one factor to another. We decided what to include based on a series of workshops and conferences where experts identified important factors and determined the interactions between them. It's possible we have left some factors or connections out, or put in some things that aren't the best match to the real situation.

What's one takeaway from the model you hope a user might walk away with?

We found that even in the same model system, by changing the levels of different factors or their interactions, you could achieve sustainable peace in different ways. Moreover, there may be different paths to achieve peace in different systems. So, there's no one answer about what you should do—it may be situationally dependent and there may be multiple ways to achieve peace. Which is hopeful!

What's one thing you've learned from your work with the Sustaining Peace Project?

The team developing the Sustaining Peace Project is a highly interdisciplinary group. It was interesting to see how people from

different disciplines can come together and each bring a separate piece from their field that is important to the whole project. And the other thing I've learned is that this group is very good about working together. We don't always agree on things, but there's a lot of respect that people have for each other, especially trying to deal with things from other fields that they are not familiar with. It was nice to participate in an environment like that.

More information: Sustaining Peace Project website: sustainingpeaceproject.com/pea … h/mathematical-model

L S Liebovitch et al. Complexity analysis of sustainable peace: mathematical models and data science measurements, *New Journal of Physics* (2019). DOI: 10.1088/1367-2630/ab2a96

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