

The Art of Inverse Problems

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Abstract

Mathematical inverse problems produce beautiful and curious images. But why? The starting point of an inverse problem is the desire to see something hidden. And not just that: we can only probe the hidden thing indirectly, gathering bits and pieces of information about it, and then hope to solve a mystery based on insufficient data and mathematical models of any extra information we might have about our mystery object. Three examples: (i) a doctor wants to see a slice image of a patient's cross section, but only has available a set of fan-beam x-ray data of her along multiple directions. (ii) A photojournalist took the best shot ever, but the camera was misfocused and it was quite dark. How to sharpen the noisy picture after the fact? (iii) Ancient navigators of the Marshall Islands in the Pacific Ocean learned to find their way by just feeling the waves. This skill, deeply founded in the mathematics of scattering, also produced a wonderful form of information graphics, or rather sculpture: stick diagrams of wave motion. This talk presents images coming from various inverse problems and discusses them both scientifically and aesthetically.

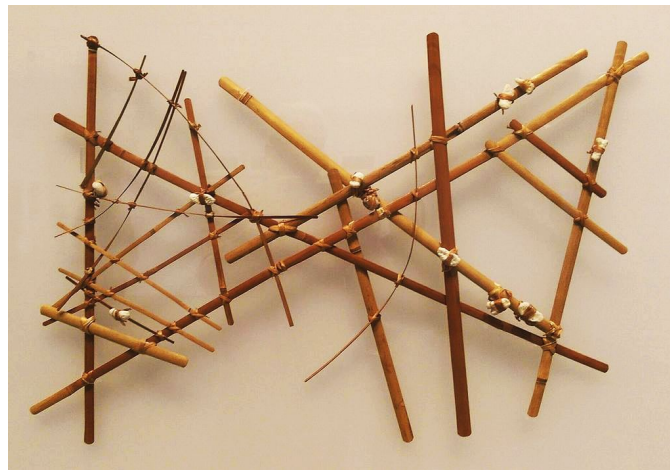


Figure 1: *Micronesian Navigational Chart.*

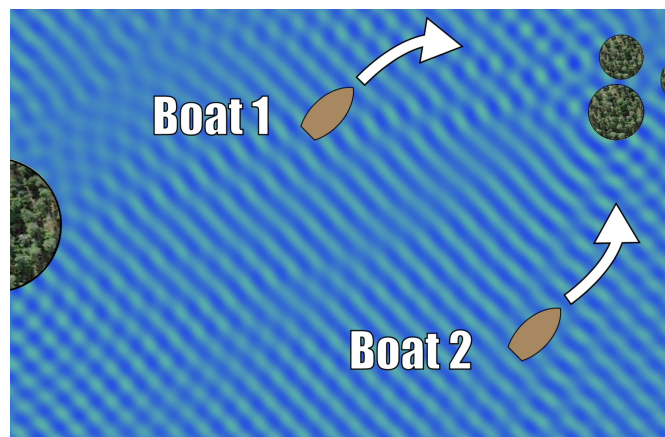


Figure 2: *Simulated Wave Motion.*