Studying random structures with confetti

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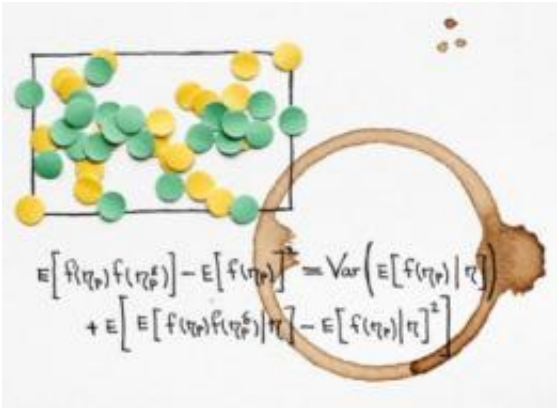

The study can be described as follows: An arbitrary number of pieces of confetti are thrown over a rectangle of given size. Some pieces of confetti will overlap one another and form continuous fields. The question in this case is whether a continuous path can be obtained in this way from one side of the rectangle to the other, which can be expected to be the case as often as it is not. To study the effect a disturbance has, a coin is tossed for each individual piece of confetti: for heads the confetti is left in place, for tails it is removed. The piece of confetti that has been taken away is then thrown out over the rectangle again, and it is noted whether a continuous path from side to side has been established. This part of the thesis is the result of cooperation with Erik Broman (Chalmers, Gothenburg), Simon Griffiths and Robert Morris (IMPA, Rio de Janeiro). Credit: University of Gothenburg

Chance and probability play a natural role in statistical physics. Inspired by confetti, researchers at the University of Gothenburg, Sweden, gain better understanding of random phenomena and refine the tools that can be used to study them.

"The result of small disturbances to random systems can be illustrated by throwing confetti. If simple rules are constructed at a small scale, it is possible to study the characteristics at a broad level. Small changes at local level can result in widely differing phenomena at global level," says Daniel Ahlberg at the Department of Mathematical Sciences of the University of Gothenburg.

Ahlberg has based his doctoral thesis in mathematical statistics on probabilities and percolation theory, which concerns the studies of random structures. Part of the thesis is a study of a fundamentally simple object: the random structure on a given surface created with the aid of confetti. The question is how the structure is affected by a slight disturbance.

"A small disturbance is sufficient, that is to say a small proportion of the confetti that has been thrown being re-positioned, for the structure of confetti to show completely different characteristics."

Probability models of this type do not have great practical application in themselves, but the phenomena demonstrated provide a pointer to what can be expected when similar physical systems are studied. This may relate for example to how liquid trickles into porous materials or spread of disease in forestry plantations.

Provided by University of Gothenburg