différence
consulting in statistics

Simulation = Lean + Statistic + Programming

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When the title is an equation, I know I will enjoy reading this!

Simulation is a computerized imitation of a system based on knowledge or assumptions about the behavior of the parts of that system, with the purpose of obtaining insight in the overall system behavior. More specifically here, we focus on "discrete event simulation" (DES): modelling of systems which change states at discrete points in time as a cascading result of specific events.

Examples of systems that can modelled using DES: material handling and conveying, road-rail-marine transportation, manufacturing shops, assembling and packaging lines, distribution centers, inter-facility network logistics, flow of people in a clinic, etc. DES can be used to validate design feasibility, find and resolve bottlenecks, plan production operations, test "what if" scenarios to increase throughput.

The nice thing about DES is that any suitable system can be represented using these building blocks:

VARIABILITY
≡ Probability distributions
≡ Delays and rates
≡ Uncertainty tolerances

MANAGEMENT
≡ Scheduler
≡ Dispatcher / regulator
≡ Assets tracking
≡ Performance monitoring

DELAY
≡ Cycle time
≡ Time to failure
≡ Repair time

RATE
≡ Vehicle speed
≡ Bulk/liquid flow
≡ Items arrival

WAIT
≡ Queue (FIFO)
≡ Stack (LIFO)
≡ Priority pick

INVENTORY
≡ Items storage
≡ Parts buffer
≡ Tank/silo

Oh! But wait a minute...

Aren't we talking about manipulating numbers and probabilities, understanding and decomposing data variability, experimenting and trying, getting KPIs and building dashboards? **That sounds like statistic!**

Aren't we talking about discovering bottlenecks, analyzing inventories and flows, adjusting buffers, reducing inefficiencies and eliminating waste and time losses? **That sounds like Lean thinking!**

And how can real-life appear "by magic" inside a computer? With user and data interfaces, decision rules, embedded custom logic and constraints, data collection and compiling? I don't believe in magic; **I trust programming instead!**

Discrete event simulation experts have to be comfortable with these three fundamentals system analysis tools. This is the way to develop useful and practical models that serve a purpose: making things work better and smoother. Call it "optimization" if you prefer...
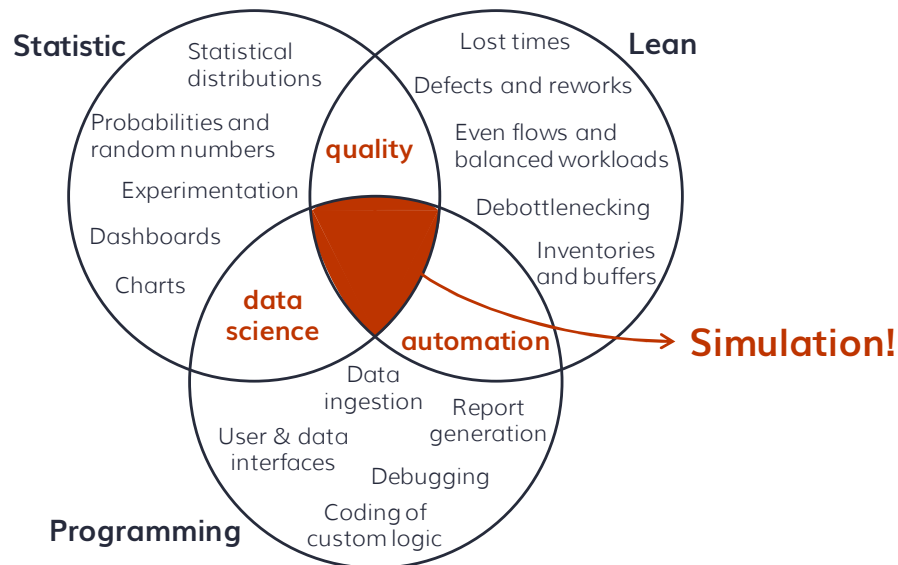
As you can see above, simulation lives at the intersection of Lean, statistic and programming. But accessorily, data science, automation and quality management skills can help!

A short illustration

We presented Différence's views on Lean and statistical thinking during an ASQ event held in Montreal (see discussion here) in April 2019. An illustration of the link between Lean (Muri, Mura, Muda) and queuing theory was made using a simulation developed to evaluate the flow of an airport baggage handling system. This model was developed using the Flexsim platform, a powerful DES software with stunning 3D graphics and limitless programming capabilities.
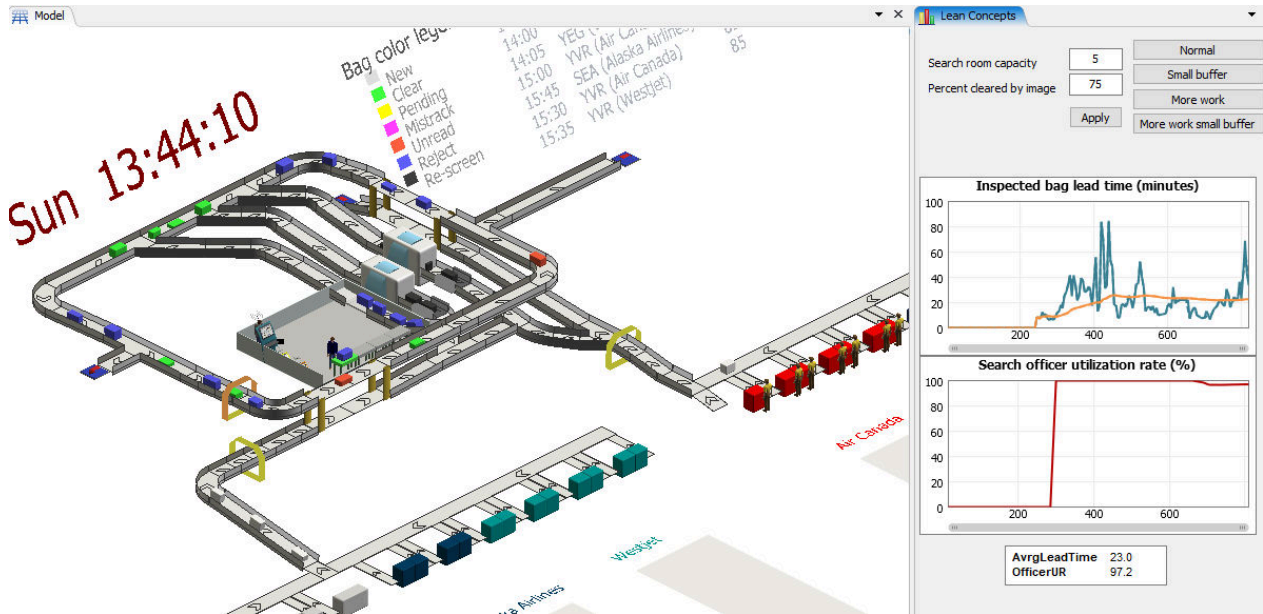
During the conference, we used the model to demonstrate Lean concepts around buffers and queuing. The simulation was used to quantify the system performance. We experimented and tested the impact of several design choices to determine the best trade-off to increase throughput and reliability without stressing the equipment and people. A copy of the presentation can be sent to you on request.

Want to learn more?

At Différence, our core expertise is centered on statistic & data science, Lean applications & operational excellence, and... simulation! Don't hesitate to ask for more information by contacting us at info@difference-gcs.com.