



Getting Real with Simulation

TECHNOLOGY WATCH

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About the Author:

Ken Karakotsios is co-founder and CEO of DecisionPower, Inc. He designed SimLife, an award-winning simulation game that put sophisticated computer models of evolution and ecosystems in the hands of millions worldwide. Prior to founding DecisionPower, he held positions at Maxis, Apple Computer, Mentor Graphics, and National Semiconductor. He graduated from Purdue University with a BSEE.

Traditional business theory postulated that the only way to discover the forces driving global marketing was to play the game and see what happens. The players then could run with their visceral gut instinct or engage in more objective top-down analysis before making their move.

The players now don't have that luxury. Markets are bottom-up creatures, not top-down entities. They aren't rational. They aren't predictable. They aren't stable. But the most successful competitors have developed methods to capture, to control, and to conquer their territory. And their most effective, most efficient tool has been simulation.

Simulation is the key to predicting the unpredictable. One cannot write an equation or create a formula to solve today's global market phenomena. But one can design a proactive computer model to capture the interactivity of a market in which every aspect of it changes each time a participant makes a move and each change is different from the last one. Simulation captures markets' interactivity because it is active, not passive. It's faster, it's cheaper, and it's safer. If the computer model doesn't compute, so what? No one gets hurt. You simply start again. Simulation enables you to fail creatively, fail unexpectedly and, possibly the best of all, fail frequently.

As marketing has become more complex, more adaptive and more unpredictable, being reactive has become more expensive, more dangerous and more financially perilous to corporate stakeholders.

Simulation technology is the key to predicting the unpredictable. By capturing the interactivity of the market, simulation proves to be a faster, cheaper, safer way of testing different strategies. Simulation enables a company to fail without actually taking on any risk associated with experimentation. By simplifying the complex, the method of simulation can help solve business problems of the future.

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Information, technology, and manufacturing move much faster in the new marketing world. Playing well at home no longer guarantees a winning record. Companies have to get their act together and take it on the road. The global market is more diverse, and therefore more competitive. And barriers to entry, at least on the Web, are much lower.

Nevertheless, world-class organizations that had lived and died with high-octane tools and allegedly potent techniques such as conjoint analysis, online analytical processing (OLAP), and campaign management continued to succumb to vexing emergent phenomena such as:

- ⊙ Increasing returns: VHS versus Beta, Windows versus MacOS, Amazon.com versus Barnes & Noble—it's not how good you are, but how fast you build share (or in dot.com parlance, grab eyeballs). Microsoft is the classic example. Although Windows was more difficult to use than the Mac, it gained a foothold in business, where the ability to share work was vital. With every new user, Windows gained more value simply because of its market share, and not because of its technology, convenience, or value.
- ⊙ Speciation: Levi Strauss was once the Kleenex of blue jeans. Then came GUESS?, Polo, and Hilfiger, speciating the blue-jeans market into high style, casual wealth, and urban cool. The PC is now the desktop, laptop, and palm-top. If you don't reposition yourself, the competition will do it for you.

- ⊙ Arms races: No one wants to get into one, but they happen all the time, from gas stations to airlines to software. The phenomena occurs in various guises: price wars, feature inflation, healthy competition, attempts to control a market. But margins in volume businesses such as manufacturing hard drives inevitably shrink when companies are forced to sell below cost. Then everyone suffers, even the consumer.
- ⊙ Customer evolution: Online trading has driven down the cost of a trade to less than the cost of a fast-food lunch. But in the process, investors have become their own advisors. Now they care about a whole new class of things, such as a broker's website reliability, where they can find real-time quotes and the Federal Reserve Board's next meeting date. This shift in priorities is rapidly eroding the business model of the broker-laden brokerage.

Traditional customer measurement tactics such as focus testing, spreadsheet runs, or case-study reviews could not have predicted these phenomena. And none of those "proven" techniques could have prevented Sony and Levi's from being the prey rather than being the predator. Incumbents no longer hold the lead.

So what better method to succeed than simulation? And what more appropriate method of simplifying the complex? This natural evolution of object-oriented programming will solve future business problems in areas of which present players cannot yet conceive. And complexity science, now largely ignored by its

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potential beneficiaries across the business spectrum, quite likely will become the standard problem-solving technique. Implementing the discipline, in which large numbers of independent entities interact with each other through relatively simple rules to produce behaviors that were not programmed into the system, will require significant shifts in traditional business procedure and practice. Workers, managers, and executives may still perform the same functions, but all will understand the dynamics of their actions differently. They will know more about how and why they made one choice at the expense of another. They will better know their customers and their competitors (maybe better than themselves). And the leaders will gain a huge competitive advantage over the followers.

These characteristics of simulation and of complexity science ought to play very strongly in the tumultuous global market. As with other complex problems, the emergent phenomena described above were not predicted by any company or by any contingent of consumers. They emerged from the interactions among companies, products, channels, and customers. And they were driven by pricing decisions, by advertising messages, and by consumer-to-consumer communication.

Examining managers' simulation-based approaches to complex issues confirms the techniques' impressive problem-solving capabilities. A modern microprocessor has millions of transistors, coupled to exquisitely stringent compatibility criteria (remember the

Pentium floating point bug?). When we sent men to the moon, we wanted to make sure they came back. There was no question that computer simulation would prove out every step of the moon shot and every execution of the microprocessor's instruction. Neither the rocket engine nor the silicon microprocessor were forged before validation with computer models. The projects' participants obviously decided to be proactive and simulate rather than be passive and wait to see what would happen. In fact, it isn't even a choice. If you don't simulate your market and your strategies, someone else will and you quickly will wish you had.

Simulation in Action

Simulation is the way to approach problems you cannot predict exactly with an equation. You therefore create a model of a system. But unlike equations, the model—which undoubtedly contains equations—isn't solved. It is run. It has inputs, it has outputs, and it has an internal state. When you simulate the inputs, it changes the internal state, and then the outputs. The new outputs then change the inputs, which change the internal state, which changes the outputs, and so on. This is known as feedback. It is the primary mechanism leading to counterintuitive behaviors in systems, even simple systems.

Spreadsheets, for all their "what-if?" fame, don't give feedback. Even the savviest marketers cannot put a box around all the external factors defining a particular playing field. If in one spreadsheet you have displayed your five-year plan based on assuming your

Even the savviest marketers cannot make accurate predictions with all of the variables defining a particular playing field. A spreadsheet alone cannot encompass the impact of these variables in the marketplace. Yet simulation technology can bring clarity to the possibilities of different strategies. By building a portfolio of virtual strategies to compare and optimize, those strategies can be played out more competitively.

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competitor will lower prices in six months, you may be able to predict the market effect. But suppose your competitor instead introduces a new product in nine months? There's no spreadsheet powerful enough to encompass the impact on the market. Simulating such a move, however, would have bought you the precious time to execute a successful counter plan.

The Marketing "System" Is Full of Feedback Loops:

- ◎ You launch a new product and the competition responds: the price leader drops its price, the innovator pre-announces something better, and the little guys reposition around you. All this data feeds back into your next move.
- ◎ You develop advertising messages and buy enough impressions to stimulate the audience. Your feedback is the number of sales. You measure your return on investment, and in response you tune the advertising, or the product, or the price.

Customers talk to each other and to potential new customers. When customers reinforce each other with positive evaluations of your product, they gain enough confidence to recommend you to new prospects, and you experience a chain reaction that feeds back on itself and creates a "hit." But customers' bad experiences also are communicated exponentially, often without waiting for reinforcement.

This interaction generates unexpected behavior in a market, seemingly from nowhere, but actually from everywhere. It's an interaction among multiple agents, millions of them in the case of marketing, sending

messages back and forth and changing their behavior in response to the messages. How else can one explain the Beanie Babies frenzy? Did Intel Corporation really expect such a huge hue and cry about its Pentium chip disaster? And did *The Blair Witch Project* become a megahit through word from the top or word from the bottom? Capturing this in simulation requires creating multiple-(or multi-) agent models of your customers, your competitors, and your company. With such a tool, you can experience the myriad of emergent failures. You also can devise the strategy that avoids most, or all, of those potential failures—before going to market.

For decades, simulation has been on the edge of business, ever since Jay Forrester unleashed System Dynamics on MIT's Sloan School of Business. However, system dynamics, although general enough to be applied to any (business) problem, is too abstract to be harnessed by business practitioners. Those folks, as do microprocessor designers and rocket scientists, need simulation delivered in solutions that have embedded domain expertise.

Domain-specific simulation has affected many aspects of business training programs, but simulation's real innovation is in productivity methods. Network modeling, for example, captures how computers route messages. Business to date has employed end-user, value-building simulation solutions in logistics, in supply chain management, and, to a limited degree, in financial analysis. At DecisonPower, though, we're changing the paradigm. We're confronting a whole

new class of classically "soft" (in other words, hard) problems, including project management and marketing. Our multi-agent simulation models provide digital analogues of real-world complex systems, informed by domain experts and tested in the crucible of real, bet-the-company business problems.

But a model is not a solution. You need to feed it information relevant to your problem. One could not develop a winning marketing strategy, for example, without information about essential factors such as price sensitivity, product feature preferences, and the social networks within the pertinent customer segments. But even inserting as much critical information as you can muster will not immediately ease your pain. So do not expect a panacea. You should first approach a simulation model as an assumption engine. Just do what you're trying to do in your brain: Feed in your gut level feelings (unless you happen to already have the data). Run the software. Suddenly, you have repeatable, objective, explainable answers as to what conditions will drive a price war or will escalate negative buzz. Now you're already ahead of the game. But it gets better.

Once you know the key variables, you can do directed market research or data-warehouse queries, back-filling assumptions with real data. You can back-test the model on historical examples, all the while developing greater certainty not in the precision of the answers, but in your understanding of the "basins of attraction," the primary modes of behavior that will help you rule your market. You build greater certainty

about what drives those behaviors, about how to know when you're getting closer to them, and about how to steer clear of the ones you don't want. Suddenly you're building a portfolio of virtual strategies to compare and to optimize. Now you can play those strategies out competitively, modeling a marketing ecosystem that generates emergent phenomena similar to what you see in the real world. And since you can anticipate your rivals' actions, you can proactively exploit the situation by exiling your competitors to a space where you want them to be and by going to a niche you know you can control.

Take the Plunge

Simulation is a necessary tool for survival in the new ecosystem. Where do you find this tool, and how do you get going? You have three choices:

- ⊙ Write your own simulation tool.
- ⊙ Buy a generic simulation tool, and build a model of the marketing mix.
- ⊙ Buy a tool that understands marketing, and build a model of your market.

The third choice is the fastest path. One marketing simulator that's ready to go is MarketSim™, by DecisionPower, Inc. A multi-agent simulation tool, MarketSim models markets from the bottom up, with the goal of reproducing real-world counterintuitive emergent phenomena. A MarketSim starts with a simulated population of individual consumers who make decisions in the whole marketing mix:

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- ⦿ Product features
- ⦿ Pricing strategies
- ⦿ Promotion campaigns
- ⦿ Channel strategies
- ⦿ Buzz

You can examine as many permutations as your brain can create, not only for your company, but for your competition as well. You can be up and running in hours. You can explore for days, you can optimize and test for weeks, and you can act on the insight you've gained. Then you can analyze real-world responses for years, which continually will make the model better and will make your market position stronger.

MarketSim is a framework for modeling consumer response. We've developed proprietary consumer models, which you can use or replace with your own. Our consumers can, among other things:

- ⦿ Remember, communicate, and forget advertising and product experiences.
- ⦿ Buy based on their need.
- ⦿ Repurchase based on consumption.
- ⦿ Weigh off arbitrary numbers of features against each other, and against price.
- ⦿ Pay attention to brand.

Yet this powerful software doesn't require a power user. If you have a PC, and know how to use a spread-

sheet, and if you have ever played a computer game, you qualify. But MarketSim is not a toy. The software drives deep financial analyses, displays highly sophisticated graphics, and generates transaction records of your virtual market(s) that you can data-mine.

What happens next? Once you have your market in your computer—the model adapting, improving, and changing as it's kept well-fed with real-world, real-time data—you have a living organism. Now more than a mere tool, the simulation has become a valuable partner for real-time decision support, creating a new level of automation in which the model becomes the control system, able to more quickly and more effectively identify the opportunities and the threats before they emerge.

The Road to Adoption: Challenges of Simulation

- ⦿ Analytics: The things being modeled in integrated circuits, rocket engines, supply chains and financial analysis are easily quantified. Customers are not—we can't dissect a brain and find the algorithm for product preference. Instead, we need to think about what drives us—to capture these motivations and these triggers in sets of rules, and to try them out to see if they are realistic.
- ⦿ User-experience: You can't run a generator from lightning—you must be able to harness power. Models need to be general enough to apply to a broad range of problems and accessible to all the company's decision makers—not just the "quant jocks."

- © Data: The key in moving simulation model use from assumption engine to automated partner is finding the data to feed the models. In the case of marketing, this requires understanding your customers, analyzing historical data, and gathering new data. But above all, this requires starting to use a model that reflects which data matters.
- © Adoption: *In Crossing the Chasm*, Geoffrey Moore describes the market penetration of discontinuous innovations (such as multi-agent simulation in business) as a series of adoption waves. It begins with the "innovators," who pursue new approaches aggressively, and ends with the "laggards," who simply don't want anything to do with the New Way Of Doing Things. So lead the way!

more easily and more quickly identified and obtained. Deployment of simulation tools will move to real-time control of promotion, of distribution, of pricing and even of product definition. Much sooner than expected, simulation models will become like spreadsheets—unremarkable in their ubiquity. But the new kids on the block will be much smarter and far more alive. They will have become essential members of the production team.

Will mistakes be made along the way? Of course. But the time to act is now. Fail often and fail creatively. Just do it before you get in the market—and before your fiercest rival does. At the end of the day, which would you rather be: VHS or Beta?

Adapt or Die

A business is a living organism. A market is an ecosystem, a complex, adaptive system bristling with feedback. Because existing tools can't capture this essential element, they miss the whole story. Simulation is one of the most effective ways to get true insight, to obtain actionable answers and to develop robust strategies.

MarketSim brings us to the crossroads, where a simulation model for the first time reacts the way real markets do. But MarketSim is just the first step. As more businesses gain larger competitive advantages through the power of simulation, the knowledge gained en route will lead to new tools. The data crucial to winning business strategies then will be