

# Mitigating the Health and Economic Impacts of Reopening Your Slot Floor

By: nQube Data Science

The COVID-19 pandemic has had a profound impact on individuals across the globe. Shock was the first thing most of us experienced. Shuttering casinos, working from home, and that first week or two that felt like every day was melting into the next. Eventually we all settled into our new realities.

The current phase is rapid action, innovation, and invention. Casinos are focused on reopening and are making plans to ensure customer and staff safety, preserving the customer's enjoyment of being on property, and protecting their own profits throughout the process.

nQube's new Covid-19 health and profit simulator has made some interesting discoveries about how casinos can both mitigate profit losses and slow the rate of infection when reopening their property.

In brief, cleaning at random leaves many contaminated machines on the floor and results in large numbers of exposures. Tagging sanitized machines, player education, and compliance to a cleaned machine tagging system is necessary, and an infected cleaner is extremely bad for contamination. Implementing social distancing alone effectively decreases the number of slots available, concentrating players on fewer numbers of machines. Though this lowers the levels of proximity exposures, it raises the total levels of contamination and contact exposure events. When dynamic social distancing is combined with tagging and good player compliance it is effective for both kinds of exposures. Closing whole sections or banks is not an effective strategy.

Limits on player numbers and social distancing both hurt profits by decreasing effective supply and demand. However, many casinos have slot floors that are under-utilized, except for at peak times. Under-utilization provides a buffer that can help to decrease losses when machines need to be turned off to respect social distancing. Losses can be minimized by a careful slot floor optimization that selectively removes machines to enforce social distancing. High occupancy/low-mid performing machines ("distractors") are especially problematic during a partial re-opening, the Key is to strategically adjust content to redirect players to more profitable content that is still available.

## About nQube Data Science

nQube Data Science has recently adapted their advanced Monte Carlo slot floor simulation engine to evaluate the effect of casino reopening strategies on coronavirus exposure and slot floor profits. nQube, a company that designs casino optimization software, is run by Drs. Jason Fiege and Anastasia Baran.

Jason Fiege is not only the CEO and founder of nQube, but also an associate professor of astrophysics at the University of Manitoba. He has 25 years of experience with scientific computing, data modeling, and optimization. He leads R&D in slot optimization, AI-based player behavioral segmentation algorithms, optimization of slot segmentation strategies, and predictive AI systems for marketing applications.

As COO of nQube, Stasi Baran uses multi-disciplinary background to find and develop suitable applications for nQube's advanced artificial intelligence technology in the casino industry. She has 10 years of experience in optimization methods and holds a PhD of Electrical and Computer Engineering. She focuses on nQube's business operations and development.

nQube specializes in AI-assisted evolutionary optimization and data modeling solutions. Specifically, the code used by nQube is the same underlying code base that is used in astrophysics, cancer radiation treatment planning, and optimization of algorithmic trading strategies in finance to find solutions to all types of problems that face the casino industry. The backend in-house developed evolutionary AI system uses human-like "divide & conquer" strategies (linkage-learning) to solve massive-scale optimization & data-modeling problems. It is an established technology and has been featured in many peer reviewed publications since 2002.

nQube's flagship product, *Reel AI™*, optimizes a casino's mix of slot machines, and their placement on the slot floor to increase slot revenue. To do this it learns player preferences from a casino's own historical slot data, uses one of a kind segmentation techniques to segment both players and machines based on behavioural, demographic, and performance metrics. *Reel AI™* provides specific slot purchasing/retirement recommendations, leading to a mix of products that is finely tuned to the preferences of casino patrons, optimizes product placement to make the best possible use of slot floor real estate, and also provides projections of slot revenue due to these suggested changes.

## Simulating the Spread of Covid-19 on the Slot Floor

In order to project changes in slot revenue due to machine changes suggested by *Reel AI™*, nQube has developed a top of the line slot floor simulator. This simulator is based on Monte Carlo simulations which are the gold standard in understanding complex physical systems and are a good way to answer "what if" questions for complicated systems. They are also cheaper, safer, and financially risk-free, compared to real-life experiments on open casinos. The simulations we will discuss use probability distributions based on "typical" casino data. The layout is randomly generated, though simulations can be customized to use real maps and a casino's own data.

nQube's simulations assume different COVID-19 mitigation strategies to calculate both contact and proximity exposure rates, along with the economic impact due to reduced capacity. The baseline simulation has 250 players, 3 of which are infected, an uninformed cleaning staff so machines are cleaned at random, whether dirty or not, and uninformed patrons, so patrons use whichever machines

they want, regardless of how close it is to other players, and regardless of if it has been marked as cleaned or not. The baseline results are shown in the below table.

<b>State</b>	<b>Players (total,infected)</b>	<b>Cleaners (total,infected)</b>	<b>Player Compliance</b>	<b>Dynamic Social Distancing</b>	<b>Strategic Cleaning</b>	<b>Contact Exposures(events)</b>	<b>Proximity Exposures (person*hrs)</b>
Steady	250,3	25,0	0	NA	NA	500	100
Steady	250,3	25,0	75%	NA	NA	250	90
Steady	250,3	25,0	100%	NA	NA	0	80

Testing of dynamic social distancing is the next step. Many casinos are implementing a system where players can not or are told not to sit next to other players. In these simulations, players avoid sitting next to another player, but the cleaning staff are still cleaning machines at random. These simulations show that stable patterns emerge on the floor. The same slots are played for long periods of time (much longer than individual sessions), and likewise, the same machines are shut off for extended periods of time. This occurs naturally and is not enforced by the simulation. The overall effect of this is to concentrate players onto a nearly fixed subset of slots. This subset is determined by the slots chosen by the first customers. Results from these simulations are shown in the table below.

<b>State</b>	<b>Players (total,infected)</b>	<b>Cleaners (total,infected)</b>	<b>Player Compliance</b>	<b>Dynamic Social Distancing</b>	<b>Strategic Cleaning</b>	<b>Contact Exposures</b>	<b>Proximity Exposures (person*hrs)</b>
Steady	250,3	25,0	0%	Yes	No	1450	50
Steady	250,3	25,0	75%	Yes	No	700	50
Steady	250,3	25,0	100%	Yes	No	0	32

To reduce exposure events the cleaning staff should tag cleaned machines and players should be told to only play machines which are marked as such. In the next round of simulations the same dynamic social distancing as previous simulations is implemented. However, here, cleaners are aware of players finishing sessions and preferentially clean these machines. (10x as likely to clean a “dirty” machine). This has a significant effect on the player contamination rate. The results from these simulations are shown in the table below.

State	Players (total,infected)	Cleaners (total,infected)	Player Compliance	Dynamic Social Distancing	Strategic Cleaning	Contact Exposures(events)	Proximity Exposures (person*hrs)
Steady	250,3	25,0	0%	Yes	Yes	50	40
Steady	250,3	25,0	75%	No	Yes	10	100
Steady	250,3	25,0	75%	Yes	Yes	22	45

One strategy for keeping a manageable decontaminated slot floor is to close slot machine banks, or even whole sections of the floor. The simulations show that closing sections or banks does not help. Players are packed into a smaller space. This made contact exposures slightly worse than equivalent simulation without closures and proximity exposures around twice as frequent.

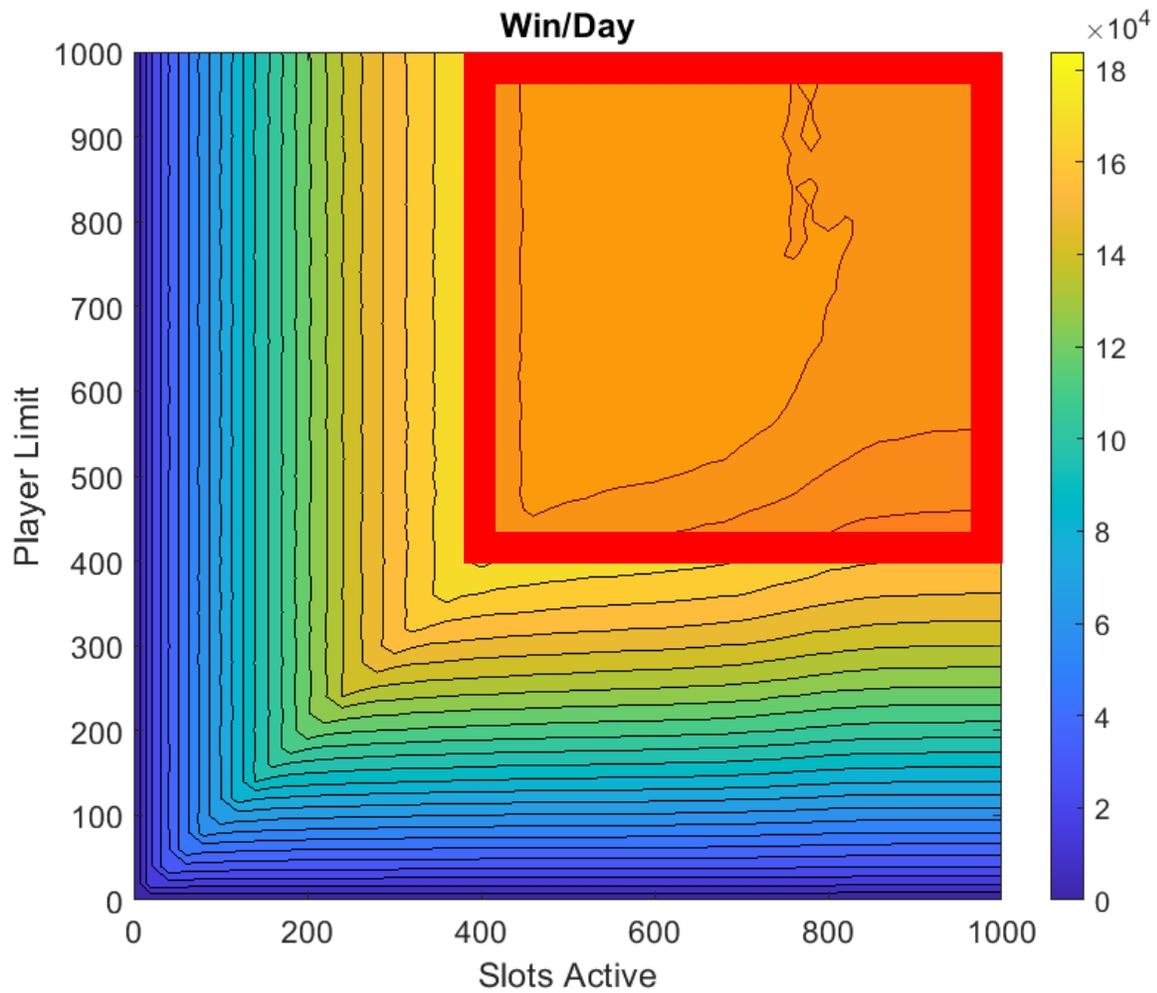
To make the simulation more accurate nQube has implemented an ebb and flow model of customer population. Meaning that throughout the day the number of people coming into your casino changes, mimicking daily event such as peak hours and closing times. This does not affect the efficiency of various cleaning and social distancing strategies on mitigating covid-19 exposure on the slot floor, however it is particularly important when considering the economic impact that covid-19 restrictions might have on your casino. Next, we will explore how player limits and turning off some slot machines will impact your slot floor profits, and how to maintain an economically healthy slot floor.

## Simulating Change in Slot Floor Revenue due to Covid-19

nQube's Monte Carlo simulations consider the economic effects on a slot floor due to two main factors that can be decided by the casino. These factors are, limiting the maximum allowed number of players inside the casino and turning off a percentage of the slot machines to maintain social distancing on the slot floor. Along with these adjustable factors some fixed factors will also be at play. These fixed factors include a reduced amount of player interest, and a possible change in patron demographics. For nQube's simulations a 30% reduction in demand has been used and the patron demographics have been unchanged, however with new data from reopening these player demographics can and will be modified in the simulations.

Given any set of casino data, the simulations are able to determine for that casino what the effect will be on profits caused by limiting the number of players allowed inside as well as shutting off some of the slot machines. Below is a plot showing the revenue of a slot floor based on these two factors.

Highlighted in the red square is a plateau where revenues stay quite consistent this can inform decisions as to what player and what percentage of machine shut offs a casino should implement to reduce covid-19 exposure while maintaining revenue.



In summary, nQube's advanced slot floor simulations can be tuned to the data of any casino in order to provide important information that will allow said casino to both mitigate the spread of covid-19 on their slot floor and to maintain profits in the new restrictive economic environment that has resulted from the coronavirus pandemic.