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# REVIEW ESSAY

## FOR FINANCIAL CERTAINTY, TRY MACHINE GAMBLING

**Martha Poon**

**Natasha Dow Schüll**, *Addiction by Design: Machine Gambling in Las Vegas*, Princeton University Press, Princeton, New Jersey, 2012, 442 pp., £24.95 (hardback), ISBN 978-0691127552

For why is gambling a whit worse than any other method of acquiring money? How, for instance, is it worse than trade? True, out of a hundred persons, only one can win; yet what business is that of yours or of mine? [Alexei Ivanovich in *The Gambler* by Fyodor Dostoyevsky (1866)]

The translucent red cube inscribed with the words 'Las Vegas' feels cool and hard in the crook of my fingers. It's one of a pair I received from a long lost friend, a gift from a playful San Diegan.<sup>1</sup> As the plastic trinket knocks haphazardly across my desk, it emits a resounding clatter. Four! I scoop it up and drop it again ... Six! And once more ... One!

An ordinary industrial die like the one I am rolling is designed to dissolve the tension between randomness and predictability. The object is a physically closed system that controls the range of possible outcomes but does not dictate the order of their appearance. So although it is impossible to know what the next roll will be if a die is fair, we can be certain that it was made so that each of six sides will turn up with stable relative frequencies.

In games of chance, players do not pit themselves against untamed uncertainty. They engage with artifacts crafted by other human beings. In a memorable passage in his book, *The Emergence of Probability* (1975), philosopher Ian Hacking takes a trip to the Cairo Museum of Antiquities to roll *talus*, the predecessors of the modern die made from the ankle bone of a running animal. After an afternoon experimenting on the floor, Hacking concludes that equiprobability is a very old invention. The ancients have carefully filed and shaped each of their pieces so that its four irregular sides will be evenly favored.

*Alea iacta esto*, let the die be cast! The odds are molded into bone or plastic by the gaming device's manufacturer.

An electronic slot machine is an elaborate version of a die. Just as the rigid polymer bodies of dice are balanced to preserve odds of one in six, gambling machines are internally hardwired with the terms they offer gamblers. But although dice and machines are both devices that manage outcomes with mastery, only one of them respects the equalizing tenets of equiprobability, while the other is designed to rake in profit.

In an ethnographic study of the American gaming industry, anthropologist Natasha Dow Schüll walks us into Nevada's casinos and supermarkets to show how gambling has been transformed by digitally reconstructed slot machines. She has been observing over 20 years the evolving landscape of Las Vegas, bearing witness to what an informant calls the technological 'deforestation' of table gaming (p. 6). 'Until the mid-1980s,' Schüll recounts,

green-felt table games such as black jack and craps dominated casino floors while slot machines huddled on the sidelines, serving to occupy the female companions of "real" gamblers. [...] By the late 1990s, however, [slot machines] had moved into key positions on the casino floor and were generating twice as much revenue as all "live games" put together. (pp. 4–5)

The original 'one-armed bandit' was a coin-operated cousin of the carnival box (an early arcade game) and the industrial vending machine. It earned the nickname for the lever that was used to pull and spin heavy rows of mechanical reels. Since the 1960s, game manufacturers have been gutting and restuffing the slot machine with silicon circuit boards and electronic paraphernalia. Apart from the touch of a finger, a digital slot does not require any physical exertion from the player to trigger randomization. Today's stochastic thrills are programmed by computer scientists, finessed by graphic artists, and wrapped up in brightly lit appliances by electrical engineers.

Rose is a slot machine technician and a devoted gambler. She confides that digital machines remain opaque and mysterious to her despite the fact that she routinely pulls them apart and puts them together. 'There's one little mystery chip in there that nobody explains to you,' she tells the anthropologist, 'and it's what spins the reels and shuffles the cards' (p. 76). 'At once programmed and capricious,' Schüll remarks, 'the digital gambling machine commands as much if not more fascination than its fully mechanical predecessors' (p. 85).

In the most intriguing section of her book, Schüll guides us through the gambling machine's digital architecture. In a succinct passage, she describes the key elements that replace conventional mechanical methods for generating random outcomes. Digital machines integrate gaming algorithms carried on the 'mystery chip', with a specialized device called a random number generator (RNG). The algorithms are sets of instructions that 'execute a game's particular scoring scheme and predetermined hold percentages (or "house edge")' (p. 82), while the RNG, as the name suggests, contributes the element of randomness.<sup>2</sup>

Schüll's description of how these two components come together inside the terminal is nothing short of astounding. 'Even as a gambling device sits idle,' she tells us, 'its RNG cycles through possible combinations of reel symbols or cards at approximately one thousand per second. The device is in perpetual motion, indifferent to the presence or absence of players.' When a player does press the 'spin' button, the computer 'polls' the RNG which instantaneously spits that moment's randomly generated numbers over to the computer program. These numbers are then translated into one of the exhaustive set of possibilities mathematically preprogrammed into the algorithms.

The mechanism Schüll lays out is severely at odds with what the average person might assume is happening based on their familiarity with mechanical play. For example, a player may feel a sense of injustice when, after leaving a machine, they see the following patron win on the very next spin. 'That was my spin,' the player thinks. But even if the first

person had continued playing, Schüll points out, 'it is virtually impossible that he would have pressed the button at the same exact millisecond as the subsequent winning gambler, thereby triggering the RNG to generate the identical winning outcome' (p. 85).

The player's confusion lies in an important technical modification that Schüll exposes but does not emphasize: in digital architecture the odds have been dissected out from the mechanism that produces randomization. Consider the material construction of a die, whose shape, weight, and size defines its response to another surface, how easily it spins, and how gleefully it bounces. The cube unifies the fixed odds of one in six with the mechanism of creating random outcomes through the physical contact of its own body with the table when it is released into the environment. In digitally enhanced gambling systems, these functions have been segregated: the range of possible outcomes and their likelihood of occurring is structured into the algorithms, while the RNG is responsible for random selection.

What is the payoff of this architectural separation? What do gaming engineers gain by decoupling the basic functions of gaming and delegating them to independent technical entities? The answer is an unprecedented operating flexibility. Game designers exercise creative discretion when they sew the two components back together. How quickly or slowly your funds whittle away, how often and how much you will win back along the way – the industry's ramped up control over every detail of play is the basis of the digital machine's prodigious profitability.

In Las Vegas, nothing is left to chance. From the floor plan of the building to the mathematical structure of the algorithms, a fastidiously crafted environment is the casino industry's multibillion dollar business proposition.

Schüll treats the digital environment as an extension of interior design. The machine is a kind of three-dimensional space that players access through a screen interface. This digital gaming space is especially plastic because technical innovations free casino designers from the traditional limitations imposed by cards, dice, and spinning reels.<sup>3</sup> For one, digitized mathematical algorithms can play a far greater number of finely tuned possibilities than could be built into mechanical apparatus, which dramatically reduces the odds the player can win big. The anthropologist discloses that in mathematical terms the algorithms are playing 'virtual reels' with hundreds of reel stops each.

Lengthened odds, however, are only the beginning of the anthropologist's story. The industry can make technical modifications that affect the player's experience far more deeply. Schüll goes on to explain that for the machine's internally calculated results to be communicated to the impatient player, the positions selected on these gigantic virtual reels must be translated into a visual output. So game designers take the number of options from the virtual reels and compress them so the player sees only 22 reels with 11 options spinning on the screen (p. 89). In industry speak, this practice is called 'virtual reel mapping,' which introduces a PRDF or 'physical reel distortion factor' (p. 90), an acknowledged disconnect between the odds that the terminal is playing, and the odds being represented to the user.

This practice is permitted by the Nevada Gaming Control Board because strictly speaking, Schüll reports, these practices adhere to the fundamental regulatory requirement that each reel outcome be determined through an independent random process (p. 94). So long as the RNG faithfully selects each virtual reel individually – exactly as it has been programmed to do – the machine is in full compliance with an existing regulation. It

would seem that the definition of fair gambling carried in the law defends the equalizing force of randomness, but is not concerned with protecting the information-content of the odds for consumers. A state-level gaming regulator makes a frank pronouncement: 'There is only one game in Nevada where the player doesn't know what his odds are' (p. 78).

The historical configuration of gambling law suggests that in the mechanical era, when the law was written, cheaters sought to rig randomization but were less successful at manipulating probabilities. As a result, so long as the selection of outcomes is random in every case, it remains legal for the gaming industry to build algorithms with a vast variety of payout option, while ruthlessly scripting the probability distributions. This is why maths is such an important site of design work in digital gaming. For example, a machine that plays with the general rhythm: lose, lose, lose, lose, win back half your losses, lose, will feel different (and will attract a different kind of player) from the one that plays: lose, lose, tiny win, lose, tiny win, lose.

The anthropologist further reveals that because of the statistical complexity of virtual reels, the influence of design does not end with the technical translation of odds into outcomes. Images must also be generated by designers to communicate these outcomes to eager players. Information management scholar Lynne Markus calls this 'symbolic expression.'<sup>4</sup> What appears on the video screen is necessary for the user to interact with the game but is procedurally disconnected from the mechanisms being executed inside the terminal. In other words, the eye-popping visual cues, which so transfix the players, are superficial to the gaming situation the person is actually facing.

What Schüll discovers is a common feature of contemporary digital systems where there is a descriptive gap between the complicated internal process of determining outputs and how outputs are transmitted to human users. Technologists must fill this gap by actively constructing a human-computer interface. And as they do so, gambling machine manufacturers – like search engine makers or credit scoring companies<sup>5</sup> – make conscious choices that will shape the public's perceptions of what's happening inside the technology. So, for example, aesthetic choice and not description, explains why some video slots preserve the appearance of spinning reels on-screen. They are there to give players the impression that randomization is initiated by their actions as it was in mechanical play. In fact, Schüll reminds us, the push of the button activates a readout of random results dictated by the sleepless RNG.

What is more, although gambling machines are programmed to dish out relentless losses, designers can arrange the symbols the player sees to cast other meanings on the results. Schüll reveals that as designers convert virtual reel results into images on-screen, they can 'map a disproportionate number of virtual reel stops to blanks directly adjacent to winning symbols on the physical reels so that when these blanks show up on the central payline, winning symbols appear above and below them far more often than by chance alone' (p. 92). So instead of another boring loss, it frequently looks and feels to the player like they have just been dealt an exciting near-win.

The cumulative effect of numerous design interventions is that gaming has become an intensely controlled emotional experience. Through the skillful guidance of game designers, gambling machines tightly choreograph the execution of chance. Statisticians structure the mathematical models so that funds are chipped away slowly and not in one blow, while the interface designers reward you with bells and whistles as the money goes. As a recreational gambler you will choose when you go to the casino, which machine to sit at, and how much money you spend. But how it feels to lose – and statistically you will

certainly be losing – is a property of extensive industry engineering.

What chance does a struggling buffet waitress stand against dedicated teams of industry specialists? This is the pressing political question Schüll is raising. *Addiction By Design* nails the connection between the intensity of digital engineering and rampant rates of addiction among video slot players.

Before the Joint Committee on Economic Development in Massachusetts in 2008, Schüll publicly testified that the vast majority of American gambling addicts play machines almost exclusively,<sup>6</sup> and in later testimony, she reported that people who qualify as addicts provide upward of 60% of the revenue the industry earns from its most lucrative product, digital slots.<sup>7</sup> She has further underlined that while sports and racetrack gamblers might seek treatment after 10–20 years, machines accelerate the course of addiction to such a degree that slot players are seeking help a mere 2–3 years after they start playing.<sup>8</sup>

The argument is that addiction research expends too much effort in trying to figure out problem individuals and not enough in examining the purposeful intent of machine manufacturers. ‘The aims among developers are no big secret,’ Schüll has repeatedly stressed to regulators. ‘How do you get people to play longer, faster and more intensively? Those are not my words. Amongst themselves [developers] discuss how to harness technology to promote what they call “continuous gaming productivity.”’<sup>9</sup>

Schüll’s incisive political point is that it is illogical to treat machine addiction as a case of individual weakness when gaming experts exercise such an exhaustive control over the digital environment – their product – to which addicts succumb. From coins to credit cards, from levers to touch screens, this research documents the intelligent evolution of a gaming product whose every detail is deliberately crafted by hardworking design professionals. ‘In the gaming industry, like other businesses, the aim is to maximize profits,’ she has told policy-makers. ‘But in effect the industry has created a highly compelling form of technology that’s proven itself over and over again to be the most problematic, addictive form of gambling.’<sup>10</sup>

Addictive behavior, Schüll argues, is the end product of a lengthy and iterative process in which game designers are actively trying to elicit the form of play that will generate the greatest revenue stream for the gambling industry. And since the most profitable gambler is the one who comes back and keeps on playing, industry specialists are boldly catering to the affective needs of people who, when offered the right ambience, will play compulsively.

Design expert Donald Norman (2002) has written that ‘Good design is also an act of communication between the designer and the user, except that all the communication has to come about by the appearance of the device itself.’ In a sense then, all Schüll is suggesting is that the gambling machine is a textbook exemplar of ‘good design.’ Good because it not only achieves the gambling industry’s stated objectives but also because it exemplifies the extraordinary efficacy of empirically informed digital design practice.

What do compulsive players want in the gambling experience? To a game developing company, this is a billion dollar research question. So the anthropologist asks addicts the same question to figure out what it is about this technology that keeps people playing to depletion. It turns out, the reasons addicted players submit themselves to uninterrupted machine play are unrelated to the vicissitudes of chance, the pleasure of entertainment, or even the thrill of winning. The anthropologist’s troubling finding is that addicts are repeatedly immersing themselves in the machines as a means of *escape*. A

gambler she meets playing at 11 in the morning in a diner explains, 'It's like a vacuum cleaner that sucks the life out of me, and sucks me out of life' (p. 186).

What's happening in the digitally manufactured environment is a gambling experience like no other that has ever existed. 'This is an activity that so completely concentrates players' attention on a series of "specific game events," Schüll reports, 'that anything troubling about their life situation physically, emotionally, socially, is going to be blotted out by this activity.'<sup>11</sup> In examining technology as built environment, Schüll shows that the addicted player is the disquieting contemporary subject that has formed as people disappear into a hypercontrolled space contrived and manufactured for them by gambling technologists.

But *who* is in control of this space? Certainly not the players who go there to lose themselves body and soul. The stunning conclusion of *Addiction by Design* is that intensive player-centric research has permitted the gaming industry to perfect an environment adapted to people seeking a kind of numbing flow that guarantees these spellbound users financial self-extinction. This place, which Schüll names the 'Machine Zone', is the gaming industry's finely tuned construction for funneling itself a predictable, consistent and legal source of income.

... So yes, Alexei Ivanovich, gambling is someone's business.

We may all be equal in games of chance, but this is not the kind of equality that machine gambling challenges. Schüll points to a very different imbalance we need to be aware of – the disparity between those who design the systems that structure the odds to enhance profitability and citizens who are relegated to the position of mere players.

And why should we care? Because what's happening in Vegas is not staying there.

Schüll's insights into how odds get managed in digital systems are relevant wherever algorithms are being used to mediate risk-based economic transactions. I have similar concerns to her in my own research on credit-scoring algorithms where technical details decided by corporate technology designers matter to the consumer's experience of borrowing and indebtedness. Algorithms do not model the odds of some greater or fixed economic reality. When it comes to risk, algorithms embedded on mystery chips *are* the system. They generate the environments in which we will play, learn, work, exchange, buy, meet, and escape.

The catch is that those who command the skills to manufacture the digital universe can engineer risk-based situations where a few will accumulate money whenever others take action within these new systems. This is why algorithmic control overwhelmingly benefits large corporations: because profit-seeking entities command the organizational resources required to support large-scale distributed engineering projects.

In both gambling and finance, digital environments are the new mediators of entrenched economic inequality. As historians have shown, the separation between these two industries in practice is a legal distinction. Through the common application of algorithmic technology to betting, borrowing, and investing, the line is once again becoming blurry.<sup>12</sup> There is, however, one important difference in the way each is being revamped by digital systems. In casinos, there is central control over the odds, and randomization is fixed in each digital product installed on the floor by game manufacturers. Things are significantly more complicated in distributed financial markets where numerous proprietary algorithms and products are contingently intertwined. In

derivatives markets, for example, there is no philosophical equivalent of the RNG, no discreet center responsible for randomization.<sup>13</sup>

Hsin Hin Lim, a gambling enthusiast who is also an equity derivatives and structured finance lawyer in the City of London translates into legal contract the terms of the financial products dreamed up by ambitious quants and investment bankers at a major financial institution. When gambling scholar Claire Loussouarn and I ask him if finance is like a casino, he tells us in a dramatic reversal of common sense<sup>14</sup>:

They keep saying that in the media, that finance is like a casino. It's much worse than a casino! When I look at a derivative product the probabilities are not known. At least in a casino the odds are certain.<sup>15</sup>

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## NOTES

1. This is the third review essay in a series of three I have written on the anthropology of finance. See also Poon and Wosnitzer (2012) and Poon (2013).
2. An RNG is a pseudorandom device used to create data for applied purposes such as statistical sampling, computer simulation, and cryptography. Philosophically inclined readers will be tempted to evaluate the fairness of gambling machines by probing the distinction between randomness and pseudorandomness. In practice, however, the distinction does not matter since these systems are considered random in the eyes of gambling law.
3. A trademarked die called the 'zocchihedron' apparently offers players 100 sides but is not equiprobable.
4. Markus and Silver (2008).
5. This point responds to an interesting conversation I had with the researchers of the CSO at Sci-Po (25 January 2013). Social scientists are usually not aware of the discrepancy between the marketing descriptions for consumers of how credit scores work and the technical function of the algorithms.
6. The Bosley hearing, named after Representative Daniel Bosley, was held in Massachusetts on 18 March 2008 in response to legislation to build three new casinos proposed by then governor Deval Patric. A video of Schüll's testimony was uploaded 22 March 2008. Accessed 19 March 2013. See <<https://www.youtube.com/watch?v=cH4ccu0WEsM>>
7. October 2009 Hearings on expanded gambling in Massachusetts, accessed 19 March 2013 <<https://www.youtube.com/watch?v=B1CGWyT27-Y>>
8. October 2009 Hearings on expanded gambling in Massachusetts, accessed 19 March 2013 at <<https://www.youtube.com/watch?v=B1CGWyT27-Y>>
9. Bosley hearing.
10. October 2009 Hearings on expanded gambling in Massachusetts.
11. Bosley hearing.

12. For an insightful comment on a slightly different question, i.e. whether it is helpful to speak of 'casino capitalism', see Cassidy (2009). For a public comment that links the hardwired advantage that casinos have over players to the position of electronic exchanges in algorithmically mediated equities trading see Cooperman et al. (2012).
13. Financial theory assumes that prices move randomly for the asset underlying a derivative contract. In turn, according to derivative valuation theory, this random movement of the asset price will drive the value of derivatives. According to philosopher and former options trader Elie Ayache, however, the relationship between the price of the underlying asset and the market price of derivatives is less clear-cut. He argues that because derivatives contracts are written to trade immediately and independently of the underlying asset, the prices generated for derivatives in the markets will correspond to the series of derivative contracts as they get written with increasing complexity and exchanged, and not to the series of price changes of the underlying asset (see Ayache 2010).
14. The political work of distinguishing legitimate financial activity from speculative activity is an important topic that joins the history of gambling and finance (see, for example, Loussouarn 2013).
15. Personal communication, 7 March 2013.

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