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Dissertation project: *Betting on Computers: Digital Technologies and the Rise of the Casino Industry (1950-2000)*

Chapter 1

Reimagining a Gambling Technology: The Digitization of the Slot Machine (1970-2000)

For millions of Americans in the late 20th century, the slot machine, with its blinking lights, garish artwork, fast-spinning reels, and loud speakers, epitomized desire and fun, money and freedom, escapism and hope. In hundreds of casinos nationwide, hundreds of thousands of slot machines put life-changing jackpots at the fingertips of anyone believing that luck always sided with those who dared to challenge even the slimmest odds. Simple, fast, and cheap to play, the slot machine became the technology of choice for most casino goers in an era when gambling was emerging as a respectable, accepted, and legitimate enterprise.

In this chapter, I explore the evolution of the slot machine since the 1970s by looking at the gradual replacement of its mechanical parts with digital components, the ways in which the culture of the casino floor and the specifics of the mechanical machine shaped the development of its digital successor, and the opportunities it created for casino managers, manufacturers of gaming technology, and gambling regulators. The narrative of the deployment of digital slot machines in casinos yields insight into the process of re-imagining a technology by its designers and operators with the purpose of surmounting the problems associated with its use. I argue that

the transformation of the mechanical slot machine into a digital device emerged as the technological fix devised by engineers and casino managers in reaction to the early machine's unreliability, vulnerability to cheating, and cumbersome auditing. Nonetheless, the digitization of slot machines and their consequent integration within computerized information, communication, and control systems provided managers with the highly regulated and effective means to streamline the activity on the casino floor as well as diversify and broaden the casino customer base. This narrative also touches on the direct connections between the deployment of digital technologies in casinos and the rise of a corporate style of casino management, geared on high profits and performance. In the process, as the digital slot machine also came to serve lawmakers' interest in ensuring a fair game for both casinos and players, gambling rose to public prominence as one of the favorite pastimes in the United States.

I. The Background: Las Vegas Enters the Corporate Era

In the late 1960s, after two decades of standing out as the only state where casino-style gambling was permitted, Nevada gradually transitioned to a new era. After years of state regulatory efforts aimed at weeding out the influence of the organized crime, the casino industry opened to mainstream corporate investors. In 1969, the Corporate Gaming Act allowed publicly traded companies to own casinos, provided that all major stockholders and top managers passed the background check administered by the state. By simplifying the previous provisions that required the licensing of every shareholder of a company that owned a casino, this act was meant to trigger the interest in casino investments by large and financially potent businesses. At stake was not only the respectability of the industry but also the very existence of the gaming-generated taxes that filled the county, state, and federal coffers. With an improved and more

functional regulatory code in place, which gave the state the right to eliminate any stockholders suspected of “undesirable activities” from a company, Nevada regulators established a business climate that would shortly prove its efficiency.

The shift of the Las Vegas Strip from the position of the “bank of America’s organized crime,” as President John F. Kennedy aptly described it in 1961 to that of the respectable corporate turf of the 1970s and onward took place gradually. A pivotal breakthrough occurred in 1966, when Howard Hughes made Las Vegas his residence. This widely respected but rather bizarre aviator, engineer, film producer, and entrepreneur launched a real estate shopping spree, which included casinos along with non-gaming related properties. Over the next several years, the Desert Inn, Sands, Frontier, Landmark, Castaways, and Silver Slipper casinos as well as thousands of acres of land in and out of Las Vegas entered the ownership of Hughes’ business conglomerate.¹ Although, as far as the funding of new buildings or renovation projects, Hughes did not leave a significant mark on the history of local casinos, in the long-run, his untarnished and solid reputation as a shrewd entrepreneur proved that clean business was possible and profitable in Nevada. With the passing of the Corporate Gaming Act, smaller companies like Showboat, Harrah’s, and Del Webb also chose to go public but secured the control of the previous owners over their operations. The restaurant and discount store chain Lum’s and Hilton Corporation followed soon thereafter. While Lum’s acquired Caesars’ Palace, Hilton purchased the Flamingo and the International, then the two largest casino-hotels of Las Vegas, from Kirk Kerkorian, a visionary real estate and casino entrepreneur. By 1976, nineteen casinos on the Strip

¹ Hal Rothman, *Neon Metropolis. How Las Vegas Started the Twenty-First Century* (New York, London: Routledge, 2002), 20-21.

had entered into the hands of twelve publicly traded corporations and were generating almost 70% of the casino revenues on the Strip.²

This involvement had several key consequences. On the one hand, in combination with tighter regulation, it began improving the reputation of the gaming industry. With millions of ordinary citizens sharing the ownership of casinos and gaming-generated profits, the anti-gambling rhetoric relaxed in an early prologue to the nationwide expansion of legalized gaming that would begin in 1978. Provided that all of their financial transactions were transparent and complied with the law, casinos, in the eyes of many Americans, became nothing more than profit-driven businesses competing for a fair share in the entertainment market. Secondly, with Wall Street taking over the selling of their stocks, casinos began receiving a much needed infusion of capital that alleviated the financial crisis, which had been plaguing the industry in the 1950s and 1960s. The sizable amounts of capital legally generated on the stock market dwarfed the relatively modest mob contributions, thus turning the spread of ownership to the public into a legitimate, potentially successful, and, therefore, desirable alternative.

Initially, the takeover of Nevada casinos by mainstream corporations was “not a substance change but a scale one,” according to historian David Schwartz.³ Because the new management inherited and administered a relatively new (only 10-20 years old) built infrastructure, most of the construction work consisted of hotel additions and expansions. At the dawn of the corporate era, the Strip was an eclectic collection of insular resorts of all sizes and shapes, illustrating the evolution of the casino resort paradigm from the early modern days of gambling in Las Vegas. Quite common were the old (first-generation) structures resembling

² David Schwartz, *Suburban Xanadu. The Casino Resort on the Las Vegas Strip and Beyond* (New York: Routledge, 2003).

³ Ibid. 2, 169.

typical commercial strips in suburbs nationwide. Surrounded by vast grounds with manicured lawns and swimming pools, these low-rise motel buildings connected through terraces and patios to a multi-purpose central structure housing the casino, restaurants, and show rooms. A second generation of properties emerged in the mid-1950s, with the opening of the Sahara, Sands and Riviera, which integrated medium-sized hotel towers and low-rise structures containing all the typical functional amenities -- casinos, restaurants, theaters, and convention halls. Most impressive in terms of scale were the first two mega-resorts on the Strip, inaugurated in 1969 and respectively 1973. The International and MGM Grand with 1,000 and 2,100 rooms respectively pushed the concept of self-contained complex to a new level, by integrating all ancillary amenities within a relatively reduced perimeter.⁴ However, regardless of their size and design, but not by coincidence, all these properties featured a centrally located casino floor, surrounded by the other facilities and accessible from all directions to the hotel guests and outside visitors alike.

II. Overview: Early History of the Slot Machine

Along with other types of coin-operated devices, slot machines emerged and proliferated at the end of the nineteenth century. Ingenious products of the Industrial Age, penny-in-the slot contraptions targeted the early modern consumers' desire for goods and fun. While, in exchange for nickels and pennies, automatic vendors dispensed small items ranging from stamps and postcards to hairpins and refreshments, amusement devices sold a new form of technology-mediated amusement. Easy to use and highly appealing in their look, coin-operated entertainment devices dominated the turn-of-the-century urban landscape (streets, stores, train

⁴ Ibid. 2, 147-174.

stations and other public spaces), transforming cities into huge playgrounds.⁵ A distant relative of fortune tellers, lung testers, stereo viewers, and arcade games, the slot machine added the element of chance to the enjoyment of play.

The predecessor of the modern slot machine came out from the workbench of a German-American mechanic in San Francisco in 1905. Charles Fey combined and expanded the features of already existing coin-operated gambling devices into an invention that shortly caught up with the public. The success of Fey's Liberty Bell partly drew from the simplicity of its operation. After inserting a coin into a countertop steel box, the player pulled a side handle that set in motion three reels with symbols printed on them. The payout depended on the combination of symbols aligned along the pay line seen through the viewing window. A system of mechanical reels, stops, pulleys, and levers ran the entire mechanism and the randomness of the spins guaranteed a fair chance for all players. The user decided the pace of the play by inserting the coins but once the handle was pulled, the machine ran fast and the winning combinations, usually small amounts, were instantly paid by the machine itself. With no skills and human interaction involved, the slot machine made gambling available to those who had found poker and other table games complicated or socially intimidating but still wanted to take a chance at making "something for nothing."

During the next half century, the slot machine had a rather peculiar development. On the supply side, a host of manufacturing companies rushed to adopt and improve Fey's prototype. The most popular models came from companies specialized in coin-op equipment (vending machines, jukeboxes, pinball games and even musical instruments and type writers) such as the giant Mills Novelty Company (that boasted over 600,000 machines produced prior to 1931), O.

⁵ David Nassau, *Going Out. The Rise and Fall of Public Amusements* (New York: Basic Books, 1993).

D. Jennings & Co, Caille Brothers, Pace Manufacturing Company, and Watling. Midwestern cities such as Chicago and Detroit became production hubs that, via distributors and route operators (jobbers), supplied machines to saloons, restaurants, groceries, cigar stores, barber shops, and penny arcades throughout the country.⁶ At the time when slot machines expanded the demographics of gamblers and incorporated gambling into the everyday fabric of urban and rural life, the anti-gambling rhetoric of moral crusaders grew stronger. People falling prey to the vice as well as the tempting machines were equally incriminated. In reaction to the legislation closing down to gambling state after state, manufacturers embraced new and creative survival strategies for their money-making devices. For instance, under unfavorable circumstances like police raids, the operator could easily activate built-in features of the machines and camouflage them as legal merchandise vendors or payout devices returning trade tokens to be exchanged for merchandise. Beginning with the Prohibition era, slot machines gradually drew the attention of bootlegging syndicates, at first probably as amusement devices to augment the inventory of illegal speakeasies and entertainment locales. Later, due to their popularity with the public, which translated into higher profits for operators, slot machines became a fixture in casinos and gambling halls, under the growing control of organized crime groups.⁷

III. The Trouble with Slot Machines

Casinos in the 1950s and 1960s inherited a slot machine that closely resembled its predecessor from the turn of the century. Over the years passed from the invention of the device, the cosmetic and technical alterations advanced by manufacturers did not succeed in

⁶ Richard M. Bueschel, *Lemons, Cherries, and Bell-Fruit-Gum* (Denver, CO: Royal Bell Books, 1995), 50-170.

⁷ For a more detailed account of how slot machines became associated with the criminal underworld, see David Schwartz, *Suburban Xanadu. The Casino Resort n the Las Vegas Strip and Beyond* (New York: Routledge, 2003), 18-23.

fundamentally improving its mechanics or alleviating its inherent functional problems. Vulnerable to cheating, requiring a complex auditing, and labor intensive as far as the staff needed for its service and operation, the slot machine raised complex challenges to casino operators. Despite its perceived entertainment value with players, the device produced modest revenues compared with table games and had a rather symbolic, however pervasive, presence in casinos.

The configuration of the casino floor did not change much prior to the early 1970s. Table games held a dominating position, always in the center of the room, so as to grab the attention of the passers-by and provide players with space for action. Crowds, standing or sitting on high chairs, massed around poker or craps tables and roulette wheels that were spaced out in long rows. Off to the side of the main floor and occupying only a marginal position and a smaller space as compared to the tables, were banks of nickel-plated slot machines. Sharing a common look, all with wheels and black-balled handles on the side, the machines had their place near doors, elevators, bars, reservation desks or along hallways. The slot area was more of a transition space (there were no chairs for players), an indication that the machines played a rather secondary role in the economy of the casino floor.



Figure 1- Harrah's Lake Tahoe ca. 1970.

The rows of slot machines in the back right of the main casino floor occupy a marginal position compared with table games. Courtesy of the Special Collections, University of Nevada, Las Vegas

This minor position in the casino was partly wedded to explanations derived from the popular perception of slot machines as well as the demographics of gamblers. Slots had a strong gender prejudice attached to them. Conventional wisdom held machines as “feminine” games that required no skills and served to entertain the female companions of “serious” male poker or crap players. Machines offered a diversion wrapped in sexist terms. “When a woman plays the slots, she is considered frivolous. When a man plays the slots, he is a serious player taking a breath from more demanding forms of gambling,” contended the author of the meaningfully titled article “Those Sexy Slots.”⁸ On the other hand, the clientele of early casinos drew from the generation of men who had grown up shooting craps and playing cards in back alleys, illegal

⁸ Judy Curtis, “Those Sexy Slots” *Gambling Times*, February 1978, 70.

speakeasies, and, later, in the foxholes and aboard battleships of World War II. Card and crap skills were key elements, deeply ingrained in the “masculinity” of the gambler. Casinos provided the perfect outlet for their manly impulses. Table games also induced anxiety to novices, as the excitement of the game overlapped with the fear of being embarrassed or ridiculed by the advanced players or onlookers. In addition, many young casino players coming of age in the ‘60s and ‘70s discovered the slot machine as a novelty available nowhere else beyond the borders of Nevada. This element of novelty was, of course, only a matter of perception by fresh gamblers because most casinos were still relying on the old mechanical slot machine and its newer electric-mechanical version.

The use of electricity in slot machines marked the first major improvement of the device since its early days and heralded a significant realignment of the gaming equipment manufacturing companies. The passing of the 1951 Johnson Act⁹ and the consequent shrinkage of the market determined most of the early successful producers to focus on improving existing models rather than the research and development of new machines.¹⁰ Under a new management and by taking advantage of its extensive expertise in producing and distributing coin-operated devices, Bally Manufacturing of Chicago (hereafter called Bally) emerged as a frontrunner in the industry. The breakthrough invention from Bally was the 1964 Money Honey machine, which still used most of the old mechanical parts (reels, timing mechanism, etc.) but displayed several outstanding new features. The motor driven hopper¹¹ allowed for considerably higher automatic payouts, thus cutting down payroll expenses with jackpot payers and also speeding up the game. As one casino manager remembered.

⁹ This federal law prohibited the manufacture, recondition, repair, sell, transport, possess, or use of any gambling device in all states, except Nevada, under the exclusive federal jurisdiction.

¹⁰ Richard M. Bueschel, *Lemons, Cherries, and Bell-Fruit-Gum* (Denver, CO: Royal Bell Books, 1995), 240-245.

¹¹ A hopper is the container that holds the money for payouts and also the device that dispenses the jackpots.

The maximum payout from a mechanical [machine] was twenty coins that dropped from a slide; so if a player won more than twenty coins, he waited until a slot personnel verified his jackpot and paid him the remainder in cash. This didn't just slow down the play, it kind of suggested a closure, an end the game... it tempted the customer to cease the play and walk out the door with his winnings. The new electrical-mechanical Bally, on the other hand had a hopper that could hold and dispense up to two hundred coins, directly into the pay-out tray, increasing the probability that those coins would be played back into the machine.¹²

In addition, Money Honey enjoyed a new appearance, enhanced by lights, the sound of cascading coins when a jackpot was hit, as well as a lit bottom glass display that could be personalized with the casino's name. These early improvements illustrate the leading role that manufacturers took in enhancing the capabilities of their products to increase their appeal with casino operators.



Figure 2 - Bally Money Honey promotional material
Bueschel, *Lemons, Cherries*, p. 246

The early success of Bally relied on many groundbreaking ideas advanced by a heroic figure, William S. Redd, later known as "the king of slots." Redd was a veteran salesman of

¹² Warren Nelson, Oral History, 1994, Special Collections, University of Nevada, Las Vegas, 38.

amusement devices and connoisseur of the trends in the coin-operated equipment industry. For many years, he worked as a jukebox and game distributor for Bally, mostly covering routes in the south of the United States. Las Vegas casinos of the mid-1960s, with their outdated inventory of “fifty to seventy-five years old machines,” struck Redd as the perfect ground for reform and innovation.¹³ He revealed a seminal preoccupation with questioning the basic assumptions about the slot machine -- both principles and main flaws—in an attempt to re-imagine the device on new standards of performance and profitability. In 1967, to use the unexploited potential of the market, the newly established Bally Distributing Company, headquartered in Reno, Nevada and headed by Redd, began an aggressive campaign for the diversification of the slot machines produced by Bally in Chicago, Illinois.

Redd and engineers at Bally, who often got intrigued by his ambitious projects, introduced several pivotal changes in the mechanics and philosophy of the electro-mechanical slot machine. First, Bally set the option of playing multiple coins on the same machine. The more the coins played, the higher the chances to win larger payouts. Up to that point, the standard of the casino floor was the “single-coin machine,” whereby a coin would buy a single pull of the handle. Also Bally pioneered the formula of winning with vertical, diagonal, and zigzag lines as well as combinations that were read from the left to right of the display. Nonetheless, Redd pushed for the improvement of a feature that would become a technical standard and measure of productivity for the slot machine in the years to come. The speed of the game emerged in connection with an economic rationale: the increased payout of the machine. “The player came to win,” said Redd, “he didn’t come to lose, [so] speed it [the game] up, give him more, be more liberal. Let him win more, but then [you make money] still with the speeding

¹³ William S. Redd, Oral History, 1983, The Mississippi Oral History Program of the University of Southern Mississippi, 26.

up, because it was extra liberal.”¹⁴ The innovative formula of faster games combined with higher payouts shook a long held assumption. “For some reason or another, everybody in that business reasoned that the larger the denomination was the tighter the machine would get, and it should be just the opposite...A dollar slot machine... must be tremendously liberal than a penny machine or a nickel machine.”¹⁵ The dollar machine set to pay back 90-95 percent of the coins that came in through the slot became one of the most popular games of choice in Nevada in the 1970s and onward and demonstrated a fresh and viable direction of growth for a perceived unproductive gaming technology.

However, most of the slot machines in use in the 1970s were “old-timers” that involved meticulous maintenance. The existing casinos, with only a few exceptions, dated from decades ago and the new owners inherited not only their built infrastructure but also their gaming equipment, which survived the passage of time with little or no alteration. The staff also made a gradual transition to the new era and many “old school” slot managers preferred the manufacturers and technology that they had been used to. In-house mechanics fixed and improved the old machines at costs much lower than the purchasing of new, lesser-known, and presumably less-reliable products. For instance, Harrah’s in Reno and Lake Tahoe favored the mechanical Pace machines, one of the most popular pre-WWII brand, whose production was discontinued in 1950.¹⁶ The maintenance of those machines, as a former employee recalls, was an around-the-clock job, because any of the approximately 1,000 parts that comprised a typical three-reel slot machine could break at any time due to abusive use or normal wear and tear. “Every part that broke on those machines, we had no parts to replace it. You repaired it. You

¹⁴ Ibid. 11.

¹⁵ Ibid. 11, 27.

¹⁶ Ibid. 10, 212.

welded it or you made a new one.”¹⁷ Half of the team at Harrah’s worked the “cripples” (machines that broke on the floor and came to the shop for emergency repair) and the other half concentrated on the periodical check-up of the slots in use. In between, new machines were made of old components to replace the lost inventory and cover the necessary required by the expansion of the casino floor.



Figure 2 - Slot Machine Workshop, The Mint Casino, Las Vegas, 1969
Courtesy of the Special Collections, University of Nevada, Las Vegas

The web of human relationships woven around the slot machine has always had a salient element of suspicion but the corporate era put an interesting spin on it. Decades of concerted efforts by manufacturers and operators of slot machines to circumvent the law and maximize their profits at the expense of honest players tainted the reputation of the device and forged its widely-used nickname “the one-armed bandit.” This unflattering moniker evoked the alleged dishonesty of the device and the seemingly unavoidable risks taken by gamblers pulling the

¹⁷ Mondo Rueda, Oral History, 2003, Special Collections, University of Nevada, Las Vegas, 43.

black-balled side handle. The arsenal of methods available to crooked operators derived from the very basic nature of the mechanical nuts and bolts of the slot machine. The large number of pieces controlling the spinning of the reels and the payout mechanism pertained to a wide range of ingenious cheating tricks using pins, switchers, and plugs placed inside the steel box, away from the player's sight. In the 1960s, the passing of the legal package meant to encourage the public investments in the gaming industry, considerably tightened the framework in which casinos could and had an interest in manipulating their gaming devices. The regime advanced by the Nevada Gaming Control Commission, a regulatory state agency founded in 1959 by the Nevada Legislature, put in place an effective apparatus meant to clean up the image of gaming establishments. Suddenly, a sword began hanging above the heads of casino executives: licenses could be revoked, should corrupt machines, shady games, and rigged cards be discovered by gaming control agents. There was only one crystal clear option left to casinos: to continue to function and make profits for their stock holders, executives had to make sure that all of their operations (gaming devices being included here) were honest and complied to the law. From now on, cheating the machines became the sole realm of dishonest players and casino staff.

However, the changes in the profile of the thieves affected neither their methods nor the vulnerability of the slot machine. A casino management textbook published in 1974, summarized the most popular cheating schemes of the time and alluded to the ongoing "cat and mouse competition" between crooks and casinos. A first type of fraud had the goal of obtaining free plays and involved the use of slugs (counterfeits or foreign coins of the same size with those accepted by the machine) and strategies such as "stringing" (a coin attached to a wire, which could be pulled back from the slot after the reels span) and pouring laundry detergent into the slot to block the handle into the play mode. Another scam had the goal to control the reels by

stopping them in the desired position with help from magnets, “shims” (pieces of wire inserted into holes made in the metal case or the front glass window), and by shortening out the electric circuit that started the machine. Experienced gamblers relied on the gadget-free but more skilled “rhythm playing” method that consisted of the repeated pulling of the handle at a specific moment before the reels stopped. Nonetheless, a couple of more direct tricks focused on the cash in the machine. While “handle slamming” took advantage of machines with worn-out parts that, under shock, could release the payoff parts, “spooning” required a special device to open the slides that discharged the coins.¹⁸ The alarming growth of cheating from slots, which amounted to \$12 million in 1971, energized the concerted counter-action of casino executives and manufacturers.

Preventing illegitimate payoffs was a two-pronged approach. On the one hand, it involved the technical upgrading of the machines to proof them against cheating, an effort taken over by most manufacturers. A major selling point of the 1964 Bally electro-mechanical Money Honey model, promoted under the slogan “Jet Age Perfection on Fruit Reel Amusement,” was the original “slug rejector” (that “proved positively cheat-proof, jam-proof, and trouble-proof”). In addition, the “stress-guarded mechanism” protected the handle, “Players can jerk and fidget the handle to their heart’s content... pull as hard and eccentric as they wish... without injury to the mechanism”.¹⁹ The manufacturers’ claim of the 100% cheat-proof machine was rather exaggerated but, as a promotional strategy, it continued well into the 1990s. At the same time, a great deal of tinkering with the slots took place in casino shops under the direct supervision of casino managers, who best knew the immediate needs and challenges of the floor. Harrah’s

¹⁸ Bill Friedman, *Casino Management* (Secaucus, NJ: Lyle Stuart, Inc., 1974), 227-233.

¹⁹ Advertisement for The Money Honey slot machine in Richard M. Bueschel, *Lemons, Cherries, and Bell-Fruit-Gum* (Denver, CO: Royal Bell Books, 1995), 237-238.

Casino, for instance, established an experimental shop in Reno as early as the 1960s, where many future successful ideas would be first tried (i.e. the giant slot machines -- later called "Big Bertha," front opening machines, handles placed on the left side of the machine, seats fastened to cabinets). In these shops, mechanics worked hard to stay a step ahead of dishonest players. "The biggest thing that we were looking for was slot cheating," remembered a former slot repair manager at Harrah's²⁰ and, under this impetus, anti-cheating implements such as anti-rhythm and anti-string components, electrical switches, and door blockers were perfected. On the other hand, the prevention of fraudulent activities associated with the machines became an integral part of the casino management policies and procedures.

A closer look at the 1978 "Slot Department Procedures" issued by the Silver Slipper Casino in Las Vegas -- a document similar to *modus operandi* packages adopted by other casinos -- reveals more not only about the vulnerable spots of the slot department, but also the specific tasks assigned to each staff member and the extent to which the management went to prevent the misuse of gaming equipment.²¹ The organization chart of the department, which operated about 300 slot machines, shows the hierarchy of the slot personnel based on the type of activity they performed: floor operators (change people and attendants), mechanics, and cash handlers (coin wrappers and booth cashiers). All three groups reported to the slot manager, a direct subordinate of the casino president. Of course, the mechanics' main duty pertained to the functioning of the machines, whose most sensitive parts (handle, reels, hopper, door, and upper unit) required quarterly check-up and maintenance. In addition, mechanics, on a daily basis, had to inspect all the machines that had been reported as losing money during the previous day (the repairs always

²⁰ Mondo Rueda, Oral History, 2003, Special Collections, University of Nevada, Las Vegas, 83.

²¹ *Silver Slipper Casino Slot Department Procedures*, 1978, Special Collections, University of Nevada, Las Vegas. Similar provisions can be found in the procedures issued by the Tropicana and Harrah's casinos, both in the collections at UNLV.

began with the largest denomination devices) and all the broken machine meters. Floor attendants watched specific areas of the floor to identify the out-of-order machines, paid small jackpots, interacted with the customers, and notified supervisors of any suspicious activity. Change personnel, the lowest position in the hierarchy of the department, carried around carts with about 20 pounds of coins and assisted the floor attendants with paying jackpots. Shift supervisors managed the activity of all the subordinated staff and conducted the collection of the machine drop and all the money transactions between the slot department, cashiers, and the vault. In case of discovering any sign of fraud, shift supervisors had to seal the machine and then notify and hand in the case to the Gaming Control Board for further investigation.

The circulation of the cash pumped in and out the slots created a highly bureaucratic financial and audit system whose characteristics and ramifications were dictated by the technological parameters of the machines. As far as their capacity to keep track of the monies they took in and paid out, mechanical and electro-mechanical gaming devices were rather rudimentary and unreliable. The machine was designed to direct the coins inserted into the slot to the hopper, the special compartment that automatically dispensed the jackpot winnings. If the hopper was filled to capacity, the surplus of change from the slot fell into a drop bucket or bag located at the bottom of the machine. To ensure the optimal functioning of the machine, the drop needed to be collected and the hopper filled up periodically. Both of these operations as well as the repair of the machines bore an inherent risk as they made cash accessible to every person opening, legally or illicitly, the machine's door. Most slots of the 1970s came out from the manufacturers' assembly line or the casino shops equipped with meters of various functions. Despite their capacity of recording the coins in the slot and the paid jackpots, meters had obvious limitations. They were susceptible to manipulation by mechanics. More importantly, to

accomplish their basic “watchdog role,” meters needed further human (and, therefore, subjective) intervention as the information they provided had to be read and manually registered.

To comply with the law and limit embezzlement by their own employees, casinos adopted a policy of mistrust that took the shape of a complex audit paper trail. Each coin that went into the slot or hopper and came out into the payoff tray or drop bucket needed to be accounted for and had to be reflected in myriad of forms written along the path from the gambler’s pocket to the cashier’s cage. Every time money changed hands, a form had to be filled in and filed. “You don’t let nothing go unless you get something [written] in return,” eloquently summarized this casino policy an employee.²² The internal procedures at the Silver Slipper Casino indicate the extensive scale of the paperwork as well as the complexity of the slot cash flow control. The shift supervisor was in charge of checking and signing numerous forms (most of them in duplicate and triplicate) pertaining to (among many others) the use of keys (machines, coin storage cabinets, etc.), jackpot payouts, slot fills, carousel pays, slot drop, meter readings, slot count, and leased machine count. Each of these activities required the participation of several employees from all the hierarchical echelons (to eliminate the situations where people were alone with uncounted cash), who also had to sign the forms.

Manual processing of these forms was the norm. “My system had to do with a bunch of 5-by-7 cards,” remembered a slot manager, “I had one card for each machine in the place, and every drop I wrote down the win, the handle, the jackpots, and the fills on these cards. I had it set up so I could have 14 weeks worth of information on each side, so I had a quick reference to see how each machine was doing. It took me half a day to sit down and put all this information in.”²³

²² Herbert G. Lawson, “Blue-Chip Operator: Harrah’s Leaves Little to Chance at Casinos” *Wall Street Journal*, March 17, 1977, 1.

²³ Cecil Fredi quoted in “Casinos in America: Then and Now” *Casino Gaming Magazine*, August 1986, 40.

In casinos where computers were available, a combination of manual and automated work verified the accuracy of the money handling. First, during the slot drop, staff member teams entered the meters' readings on forms that were afterwards used for manual input of data into computers. As drop buckets were being collected from the casino floor, they were transported into the count room, where their content was moved onto a scale that automatically recorded the corresponding dollar amount.



Figure 3 - Coin Counting Room, The Mint Casino, Las Vegas, 1969
Courtesy of the Special Collections, University of Nevada, Las Vegas

Another machine proceeded to wrapping the coins and reporting the total drop by denomination for all the collected cash. These figures were entered on a count sheet that was then checked and signed by all the members of the counting team. The amounts reported by the scale were also introduced on a slot drop report that, along with the hopper filling and jackpot forms, were sent to the computer center. Finally, to balance the results and signal discrepancies, the computer cross checked the information on the forms received from the counting room with that on the meters' forms. The processing of all the information took several days, depending of the

frequency of drop collecting (some casinos did it only once or twice a week) and the speed of data entry in the computer center. This system was rather reactive, tedious, and inaccurate as a casino employee recalled, “We were a week and a half to two weeks behind (...) and between meter failure and human error, the information was just not that great.”²⁴

Ideas about the possibility to maximize revenues from slots had been around for a long time before the 1970s. From early on, slot managers understood that the popularity of a device, reflected in the gross win per machine, depended on the appeal of its design and its “looseness.” Some places, however, took a more relaxed stance about the efficiency of slot machines, arguably, because of the inferior position allotted to the slot department within the structure of the business. At Caesars Las Vegas, for instance, “you placed equipment on the floor, maintained it, and basically forgot about it,” as an early slot manager remembered.²⁵ On the other hand, at casinos such as Harrah’s in Lake Tahoe, managers were “constantly looking to improve, mainly through personal intuition as well as trial and error.” “We put it [a \$1 machine section] where we thought it should go (...) because of the traffic patterns. We moved it to another location and it didn’t do well. It took us like three or four moves when all of the sudden it clicked.”²⁶ With data about the functioning of machines beginning to be collected periodically, signs of a more scientific and professionalized approach to improving the performance of slots emerged. Slot managers adopted the term “slot mix” to refer to the combination of factors influencing the casino bottom line: machines’ location on the floor, denominations, payoff schedules, and the house advantage.

²⁴ Ibid. 20.

²⁵ “Executive Profile. David Butler”, *Caesars* (In-House Publication), 1987, No.8, 5.

²⁶ Mondo Rueda, Oral History, 2003, Special Collections, University of Nevada Las Vegas, 69.

IV. The “One-Armed Bandit” Goes “Virtual”

In the 1970s, significant advancements in integrated circuits and microprocessors, which became more effective and less expensive, gave manufacturers of gaming equipment new avenues for innovation, in response to the perceived technical limitations of the slot machine. In less than 10 years, the slot machine would go through major alterations in capability, design, and functions.

Economic historians who have studied the evolution of the gaming devices industry in the U.S. have noticed the spectacular rise to prominence of Bally Manufacturing, shortly after its takeover by a new management team in the early 1960s. By 1967, Bally claimed 94% of all the machines sold in Nevada and by 1970 it became the world’s largest manufacturer of spinning reel gaming machines. In the larger context of events, a few factors concurred to creating a favorable climate for Bally. First, the growth of legalized casinos in the international market, particularly in Europe, with many countries shifting to new and more competitive gaming machines and choosing Bally for the convenient financial solutions they developed for new customers. Secondly, on the home front, Bally encountered limited competition from the growing international companies, whose access to the Nevada market faced severe licensing procedures. In addition, Bally management adopted a strategy of vertical and horizontal integration sustained by funds resulted from shares traded on the stock market.²⁷ Nonetheless, Bally followed a principle staunchly promoted by its Nevada distributor, William S. Redd, “[the product] had to change – constantly change – in order to be successful.” Many ideas for new products and services emerged as practical solutions to real needs of casino operators.

²⁷ Mirko Ernkvist, *Creating Player Appeal. Management of Technological Information and Changing Pattern of Industrial Leadership in the U.S. Gaming Machine Manufacturing Industry. 1965-2005* (Goteborg: Goteborg Studies in Economic History, 2005), 109-125.

Technical concerns with enhancing the financial accountability and security of machines drove Bally to establish a new research lab in Reno in 1974.²⁸ Inge Telnaes, who started this lab from scratch as its director, was an electronics engineer born in Norway and trained in Germany, who gained extensive experience in the Norwegian defense industry and the computer industry (IBM) in the U.S.²⁹ One of the specific projects that Bally management assigned to Telnaes and his team was the improvement of an already existing computer system for monitoring slot machines. Bally had recently purchased from Electro Module Inc., a small California-based business, the rights for a slot system that was applied at Harvey's Wagon Wheel Casino in Lake Tahoe in the early 1970s.³⁰ The electronic board mounted on the side of each of the approximately 1,000 mechanical machines in this casino collected information about the functioning of each device and sent it, via cables, for processing into the two IBM system/7 machines in the computer center of the casino.³¹ Although functional, this pioneering slot system required further improvement and extension that exceeded the capacity of the parent company. At this moment, Bally took over the project and, over the next several years, engineers under Telnaes' direction created an elaborate new version of the system that received the U.S. patent number 4072930/1978.

The patent's title, "monitoring system for use with amusement devices," indicates that the primary purpose of this invention was the security of slot machines, particularly in "commercial establishments [where] there are often several hundred or more of such devices and the amounts

²⁸ In parallel, Bally continued to run its already existing R & D department at its headquarters in Chicago. Financing two similar departments had the goal to accelerate the design of new and successful products.

²⁹ Inge Telnaes interviewed by the author, March 4, 2009.

³⁰ Theodore R. Sabin, Michael Dahl, and Paul R. Brugger "The Slot Machine Data System, an Accounting Method, a Security Technique, and a Marketing Tool" in *Gambling Research: Proceedings of the 7th International Conference on Gambling and Risk Taking* (Reno, Nevada: College of Business Administration, 1988), 347- 358.

³¹ Ron Gallaway, presentation at World Gaming Conference and Expo November 1988, Atlantic City, University of Nevada Las Vegas, Tape 341B04.

of money that are handled by the devices as a whole are quite large.”³² As far as its logistics, this new Slot Data System (SDS) package used the same hardware as its predecessor --a central computer connected to individual machines via electronic “coupler units.” The description of this invention reveals the nature of the security issues it addressed. First, the system tracked and recorded the coin in, coin out, and jackpots, thus keeping an accurate report of all the discrete money transactions related to a specific machine, a group of devices, or the entire floor. A special software program saved the information into a database that was accessible on the terminals in the computer center. Secondly, the system intended to establish a tighter control over the interaction of the staff with the machines. Each attendant carried a personalized electronic unit, to be attached to any machine when a jackpot occurred and initialized the report of the transaction to the main computer. Knowing the name of the staff member who made the payment as well as the value of the payoff reduced “the likelihood that an attendant can make double payoffs or other transactions in an attempt to steal without being detected” and helped with keeping the “bank” (money amount) that a change/jackpot person managed during a shift. Also, “the opening of the access door to the change box (...)[could] be detected and transmitted to the computer” when a staff person used their ID card on the machine. The system did not control or affect the operation of the slots but merely monitored their performance and the staff members’ access to them.

The first commercial application of the SDS system at the Las Vegas Hilton revealed some of the strengths and weaknesses of this pioneering product. On the one hand, during its first year of operation, the effectiveness of the computer-monitored slots translated itself into a

³² U.S. Patent 4072930/ February 7, 1978 available at <http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&u=%2Fnetacgi%2FPTO%2Fsearch-adv.htm&r=127&f=G&l=50&d=PTXT&s1=4072930&p=3&OS=4072930&RS=4072930> (accessed May 6, 2009).

\$400,000-500,000 increase in revenues or the equivalent of 1% of the total profit generated by the entire casino. As Inge Telnaes recalled, behind this growth was mostly a cut down in the internal leakage of money due to negligence or malicious intent by casino employees. The monitoring of the coin in and coin out limited some slot mechanics' customary practice to round up their salary by picking up loose coins from the inside of the machine at each opening of the door for maintenance and repair. On the other hand, the SDS system created a different set of problems for the security personnel. Although the computer-generated reports eliminated the manual filling of some forms, it introduced an additional loop in the audit process. On New Year's Eve 1977, after following the usual routine of inspecting a machine and finding no physical evidence of tampering, Hilton employees paid a large jackpot to a woman player who later proved to be a member of a group of casino thieves. Had the staff checked the computer print-out before validating the jackpot, they would have found out that the door of the machine had been illicitly opened prior to hitting the jackpot and the reels set on the winning position.

In fact, mechanical reels had always been one of the softest spots of the slot machine and an issue of concern for engineers. Mechanical reels proved problematic for at least a couple of reasons. First, their crude mechanical nature involved a high degree of wear and tear and worn gears and linkages generated errors and alterations of the payoff. The optimal functioning of the reels involved a significant amount of maintenance work as well as expenses with replacing and fixing broken parts. On the other hand, shaking, tilting, and other relatively simple manual forms of manipulation could disturb the spinning and stopping of the reels, with negative consequences on the outcome of the game. Therefore, a key goal for designers concerned with finding a method to protect the randomness of the process that determined the stopping of the reels and, consequently, the alignment of symbols in the display window. While early attempts advanced

palliations consisting of mechanical adjustments or devices attached to the reels, later efforts increasingly relied on modern technology, namely solid-state components.

One invention in particular paved the transition of slot machines from the electro-mechanical to the modern microprocessor type. In 1975, the team of inventors headed by James C. Saxton patented an “amusement apparatus and method” with electronic tamper-proof features to discourage fraud and misuse. “The electronic means [actuating the wheels] is under control of nearly instantaneously acting computer means including a random code generating system, operating to govern machine operation and the time and the score. Thus the wheel stopping positions and possible score are determined by the computer means in an extremely short period of time and before any physical action on the part of the player can effect on the score.”³³ The description of the patent indicates the use of electronics as a notable advancement, “The improvement over prior art systems achieved by this system is that an amusement apparatus (...) can be operated by random code generators to produce independent random stopping positions for each wheel or indicia display device, with a varying score previously determined by a predetermined logic system.” Saxton devised a highly effective alternative to the mechanically generated “randomness.” The brain of the machine consisted of two parts: the random number generator (RNG), which replaced the winding time mechanism and arbitrarily stopped the reels in certain pre-determined positions; and a memory chip (EPROM) that stored information about the winning combinations and the payoff schedule.³⁴ A group of engineers associated with Bally

³³ U.S. Patent 4095795/ June 20, 1978 available at <http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetacgi%2FPTO%2Fsearch-bin.html&r=1&f=G&l=50&co1=AND&d=PTXT&s1=4095795.PN.&OS=PN/4095795&RS=PN/4095795> (accessed May 6, 2009).

³⁴ Following is a brief summary of how the Saxton machine worked. Every fraction of second, the RNG constantly generates random numbers from zero to several billion, even when the machine is not being used. When the handle is pulled, the player gets the most recent number. The microprocessor then looks up the value in the EPROM for the reel stopping positions corresponding to that number, spins the reels, and then, one by one, stops them at those

Manufacturing Corporation took the Saxton patent a step farther with one of the first mass-produced microprocessor-controlled slot machines. The E-1000 of 1980 and the subsequent (and more successful) E-2000 series became “the workhorse of the industry,” being found in most major casinos by the mid-1980s.



Figure 5 - Bally Series E-2000
Bueschel, Lemons, Cherries, p. 290

The introduction of solid-state electronics in reel slot machines in the 1970s paralleled another significant breakthrough development: the video gaming machine. In his innovative spur and having the backing of the strong R & D department at Bally, William S. Redd became interested in the applications of solid state electronics to amusement devices and orchestrated the acquisition of Raven Electronics Corporation in Reno in 1971. This company, under the management of electronics engineer Richard Raven (who would soon move to a satellite and communications business), had experimented with electronic blackjack machines featuring video

positions. The outcome of the play is in fact determined at the moment when the number is selected and depends only on the time of the pull and not on the previous resting position of the reels or the mechanical configuration of the system. The payout percentage (the percentage that, over the long run, the machine will return to the player) does not depend on the random numbers that determine the spinning and stopping of the reels but on the payout combinations of symbols on the reels (i.e. one coin vs. two coins back for a combination of two clubs and a spade) or the number of winning symbols on each reel. Each state regulates the minimum payout percentage.

displays and pushbuttons.³⁵ Just four years later, after breaking away from Bally and taking the exclusive rights over the video side of the business, Redd also purchased Nutting Associates, Inc. of Mountain View, California, where a then anonymous engineer named Nolan Bushnell had developed Computer Space, the first coin-operated arcade game. Because this game hit home with the community of engineers but not with the “videogames virgins of the general public,” who could not make sense of the intimidating console with TV monitor and complicated instructions, Bushnell left Nutting Associates to found his own company Atari, the “cradle” of Pong, the first commercially successful video game.³⁶ Redd continued his march towards acquiring the most promising innovation in the video game market with Fortune Coin Company in 1978. Electronics engineers at Fortune designed a machine that displayed, for the first time, colored fruit symbols in the typical arrangements of mechanical slot machines. All mechanical parts were replaced by interchangeable modules and, with the exception of the screen, the appearance of the machine remained unchanged. In next decade, drawing from all these early innovations, William S. Redd and his company, renamed Sircoma and later IGT (International Game Technology), continued to invest heavily in research and development and launched increasingly successful lines of products.

Known as “specialty games,” these new video gaming devices addressed a niche market and, initially, did not pose any significant competition to the standard reel slot machines. Video games were rather meant to function as a gimmick, to “enhance the casino floor with a spirit of excitement that draws more players to the other slot machines,” as a commercial flyer claimed.³⁷

³⁵ Richard M. Bueschel, *Lemons, Cherries, and Bell-Fruit-Gum* (Denver, CO: Royal Bell Books, 1995), 258-259.

³⁶ Steven Poole, *Trigger Happy. Video Games and the Entertainment Revolution* (New York: Arcade Publishing, 2004), 19-21.

³⁷ Advertisement for Big Bertha slot machine in Richard M. Bueschel, *Lemons, Cherries, and Bell-Fruit-Gum* (Denver, CO: Royal Bell Books, 1995), 281.

Casino executives could choose from a large variety of video devices, from bingo and keno to dice and racing machines. To facilitate the penetration of the new machines in casinos, Redd designed a distribution strategy similar to the one he had used to sell pinball machines, where he offered the devices on a participation basis (with renters paying a percent from the profits generated by the machine) and asked for space outside the gaming floor, particularly in bars. In just a few years, the video-draw poker became the front-runner IGT machine and a serious contender to the popularity of slots. This success mainly rested on the choices given to the player, as Redd later recalled, “The player gets to make his own decisions and the game is not too fast for him or too tiresome. And most of all, some way or another, the player gets an extra thrill knowing he did something to help himself win.”³⁸ In addition, the success of video machines also owed a great deal to the increased competition among manufacturers (video technology required less capital and engineering effort, therefore many new small companies joined the field) and the consequent falling prices of the machines, from \$12,000 for an IGT device in 1980 to \$7,500 for a similar unit in 1982.³⁹

³⁸ 1982 interview with Si Redd published in *Public Gaming*, quoted in Ernvist, *Creating Player Appeal*, 146.

³⁹ Enkvist *Creating Player Appeal*, 155.



Figure 6 - IGT Draw Poker
Fey, *Slot Machines*, p.217

IGT's rise to the dominating position in the market in the 1990s also capitalized on another masterful business decision. The acquisition of the Telnaes invention along with the Saxton patent – the two would be the basic principles of the modern slot machine - gave IGT an unmatched edge over its strategic competitors. In 1984, Inge Telnaes of Summit Systems, Inc. (and formerly with the Bally research laboratory in Nevada) designed a slot machine aimed at changing nothing else but the "players' attitude and acceptance of the device," by the means of increased payoffs. Up to this point, the size of a jackpot depended on the number of reels and the number and type of symbols on them. The more and bigger the reels, the higher the odds and payback combinations could be, but this interdependence had negative psychological effects on players, who perceived bulky machines as "being less good."⁴⁰ Telnaes's machine decreased the probability of winning while maintaining the external look of a standard mechanical slot

⁴⁰ U.S. Patent 4448419/ May 15, 1984 available at <http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetacgi%2FPTO%2Fsearch-bin.html&r=1&f=G&l=50&co1=AND&d=PTXT&s1=4448419.PN.&OS=PN/4448419&RS=PN/4448419> (accessed May 6, 2009).

machine. His “virtual-reel” method relied on electronically-controlled reels and stop positions determined by a random generator programmed to select a number from a range greater than the number of stop positions. The range of numbers was non-uniformly mapped to the stop positions, which allowed the probability of winning to be adjusted without altering the configuration of the reels. Telnaes’s ingenuity rested in using software instead of hardware to adjust the winning possibilities. The virtual-reel machine was an instant smash hit. The first 108 devices installed at Four Queens Casino in Las Vegas in the summer of 1984 generated double the profit from a similar number of regular, non-virtual reel machines.⁴¹

V. The Digital Slot Machine, a Gold Mine for Casino Managers

The expansion of legalized gaming outside the borders of Nevada and the changes in gaming legislation energized the manufacturers and fueled the staggering diversification of their products. In May 1978, two years after the passing of a state referendum in New Jersey, Atlantic City opened its doors to the casino industry with hopes for a fast and steady recovery of the local economy. By the end of 1981, a total of nine gaming establishments, offering about 300,000 square feet of casino floor, were already functioning on and around the boardwalk, with two more to be added in the next six years. From the very beginning, state officials endowed the New Jersey Casino Control Commission and its enforcement arm, the Division of Gaming Enforcement, with the wide-reaching power to regulate casino operations and ensure the integrity of casino gambling. Determined to steer away from Nevada’s regulation, perceived as being too loose and vulnerable to criminal influence, Atlantic City officials elaborated rules scrutinizing issues as detailed as the size of the gaming space and the 10-year personnel record check-up for every casino job applicant. As far as gaming technology, the Atlantic City

⁴¹ “A ‘virtual’ success”, *Gaming and Wagering Business*, October 1984, 18.

regulation limited casino purchases of slot machines to a maximum of 50% from the same supplier, which cracked the monopoly previously held by Bally Manufacturing Company and encouraged already established or emerging slot makers to join the New Jersey market. Foreign companies from Great Britain, Australia, and Japan also rushed in to grab a chunk of the booming slot machine business.

A gradual increase in the role played by the slot machine within the economy of casinos became obvious in the 1980s. While, during the 1971 fiscal year, slot machines generated 35.7% of Nevada's total gross gaming revenue, the proportion rose to 43.5% just 10 years later and 66.3% in 1990.⁴² This momentum showed in Atlantic City as well, where slot machines slightly outperformed table games in 1984 with 50.2% of the total win.⁴³ Some commentators linked this full-fledged boom in slots to the change in the demographics of gamblers. The typical gambler of the 1980s took more interest in electronic games rather than the crap and poker tables, the favorite choices of the previous generation of gamblers. Young people already accustomed to computers, video games, and various electronic gadgets found the gaming machines in casinos as the natural and familiar extension of everyday technology. "This new generation of players is changing the face of gaming based upon their education and technological bent," remarked a veteran Las Vegas casino executive in 1987. This considerably younger casino clientele, consisting of both men and women baby-boomers, generated a shift in gaming habits. "People are playing differently from what they did in the 60's. Everybody split 10's, everybody doubled down, everybody chased. Today they'll sit down with a \$20 bill and make that last for three hours.

⁴² *Casino Journal*, July 1990, 38.

⁴³ Ibid.

They manage themselves.”⁴⁴ Slot machines, with their appealing screens, buttons, and mounting jackpots conflated independence and fun into an experience consumed at the leisurely pace of an increasingly sophisticated and technophile player.

On the casinos’ side, in the 1980s, slot machines began breaking away from “the Rodney Dangerfield syndrome,” as an astute observer called the previous “lack of respect” from casino top managers for the slot machine department.⁴⁵ Obvious economic advantages underpinned the renewed managerial interest in slots. First, the personnel expenses with operating electronic slot machines were lower than those of tables, while the profits grew higher. With the enhanced reliability of electronic machines and the consequent reduction of the maintenance work, only a handful of unskilled casino staff ensured the functioning of a large slot area by providing change to the players. By the same token, an equal number of skilled employees could staff only several tables of craps or blackjack. Secondly, while very few new types of table games found their way into casinos, the diversification of slot machines had virtually no limits, as advancements in digital technology enlarged the array of technical and creative possibilities available to engineers and designers. “Ten years ago [1979] we only had three or four reel slot machines. Today, we have at least 60 different versions of slot machines” recalled Jim Perry, the former vice president with operations at TropWorld in Atlantic City. “The reason is that slot machine manufacturers put a lot of money into research and development spent the time necessary getting Commission’s approval to get a new product introduced.”⁴⁶ The intensified competition among the manufacturers of slot machines reached beyond the exponential growth of the supply and slashed

⁴⁴ Dora Hasan, “The Times They Are A-Changin’: Casinos Keep Pace with Shifting Demographics” *Casino Gaming Magazine*, June 1987, 4-5.

⁴⁵ Butch Witcher, vice president for slot operations with Resorts International in Atlantic City, quoted in Casino Gaming Interview, *Casino Gaming Magazine*, June 1985, 34.

⁴⁶ “Anatomy of a Megafacility” *Casino Journal*, July 1989, 45.

prices to improvements in service and attractive machine-use/purchasing plans. Nonetheless, unlike table games, digital slot machines provided slot managers with more flexibility in organizing the floor layout.

Selecting, purchasing, and placing new slot machines on the casino floor became a highly skilled and complex process. Harrah's approach in the early 1980s illustrates the main concerns that were typical for the entire industry. The first goal was to squeeze as many machines as possible into a specific area, so as to maximize the use of the square footage, while also complying with the provisions of the law.⁴⁷ Next, the location of machines was dictated by the traffic flow, aisle space, and customer acceptance of certain denominations, the latter attribute resulting from the history of similar devices, compiled at each Harrah's property. In selecting the machine brands, Harrah's officials gathered information about the performance of various new devices from trade journals, trade shows, peer conversations, and direct observation of machines functioning in other casinos. The market research concluded with the purchase of a line of machines, which was often preceded by free trials from manufacturers or lease contracts, where casinos paid specific percents of the profits to the owner of the devices. Most slot managers treated the slot mix as a work in progress, driven by the goal of maximizing the bottom line. Consequently, the need of accurately measuring the performance of each machine and players' preferences challenged the manufacturers of technology.

"We continually must strive to anticipate the customer's desires (...) [and] discipline our innovation," spelled out the success recipe an executive of a leading gaming technology company.⁴⁸ The growing popularity of the SDS system, launched in 1976, determined Bally Manufacturing to expand and improve the accounting and reporting characteristics of its product.

⁴⁷ In Atlantic City, the law required each machine be allocated minimum 10 square feet of space.

⁴⁸ Si Redd quoted in the promotional brochure "Bally. Games of Chance...Games of Choice", cca. 1980.

By 1985, SDS reached the market in three versions that addressed the requirements of large casinos (the SDS-II system was able to connect 3,000 slot machines), small casinos (SDS-IV fit for 400 machines), and casinos without the need for a sophisticated on-line accounting system (SDS-V).⁴⁹ By comparison with the pioneering SDS system, these advanced versions served a broader range of managerial necessities, offered inter-active features which allowed operators to customize the computer-generated reports, and made possible the shortening of the reporting time. As more critical information became accessible to casino managers, the slot computer system became a strategic business tool allowing for “more profitable decision making (...), faster reaction to mechanical breakdowns and security breaches, and more accurate and reliable accounting information.”⁵⁰ The following diagram from a SDS-II promotional brochure shows the main technical components of the computer system as well as its main functions.

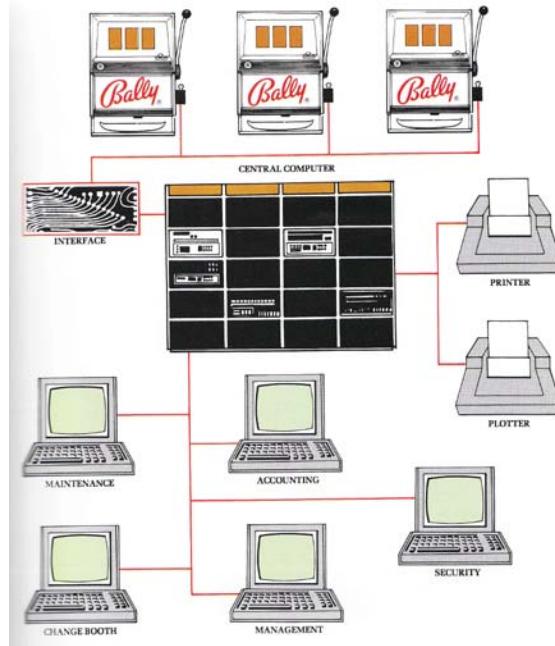


Figure 4 - SDS flowchart. *Gaming Business Magazine*, May 1984, p.4.

⁴⁹ “Bally: Still a Casino Leader” *Casino Gaming Magazine*, May 1985, 54.

⁵⁰ SDS-II User’s Guide, Bally Manufacturing Corporation, 1988, I-1.

The basic element was the slot machine communicator, a digital device attached to the side of each machine to keep track of the coin flow through the device and the identity of the employees who serviced it. The interface unit facilitated the communication between the machines and the central computer, providing both sides with the means of exchanging information. The host computer stored bulk data on disk units and fed the information to printers, plotters, and terminals placed at various locations within the casino. As a security tool, the system limited the losses by detecting the improper operation of machines, identifying the people opening the door and the cash box, verifying the fills and revenues, and reporting all discrepancies. As an accounting tool, the system kept track of all cash transactions and produced reports for the financial and audit departments. Maintenance personnel used the system to find out about the inappropriately working devices and relied on performance and comparative reports to schedule the machine technical inspection of machines and improve the floor layout and slot mix. For the management, the system prepared periodical slot summaries, revenue and performance reports, overviews of the slot personnel activity, and even floor maps to show the action of individual or groups of devices in an easily digestible format.

The SDS system functioned as an accounting, security, and management tool. “As a security tool, the system monitored reports on machine status to a central site within the casino detecting and reporting immediately any malfunction or any attempt to tamper with a machine. As an accounting tool, the system logged data such as coins in, jackpots paid, etc., generating easily-digestible revenue reports for management.”⁵¹ The success of the SDS system rested on several remarkable advantages. First, it accelerated the decision making process. “Like any other

⁵¹ Ibid. 51.

business, casinos want to know what they are doing right and what they are doing wrong. With such frequent and speedy report capabilities, decisions can be modified almost immediately if the result is unsatisfactory.”⁵² The information gathered in a timely manner identified the most profitable machines, helped managers to explain why they were successful, and allowed them to use that criteria to improve the performance of other devices. Secondly, computers facilitated a more flexible approach to the management of the floor. “It is relatively simple to group together any information that a casino wants. You don’t have to have every slot on a report. You could have just nickel games, or just quarter games, for instance. Slot machines have their own types of demographic information such as location on the floor, which can be combined to drive the slot reports.” Nonetheless, the variety of computer-generated reports offered managers the quantitative and analytical basis for anticipating trends and making strategic decisions.

While Bally’s early versions of the SDS system used digital slot machines to gauge the casino’s internal dynamics, other manufacturers exploited the slots’ capacity to reflect every gambler’s profile, turning the devices into powerful marketing tools. The slot machine already contained the digital components that were able to collect data about the user, therefore the development of the first player tracking computer system was only a matter of time. The idea to gather information about a slot player was certainly not new. “In the past we have had informal efforts such as the slot host program in place, where the host would identify himself to the player and offer kind of treatment that customers were traditionally only offered at table. The host also tried to rate their play in an informal fashion,” remembered a casino manager in 1986.⁵³ Of course, this eye-balling process was plagued by inaccuracies and bias on the side of the host. One

⁵² “Bally Expands Its Slot Data System” *Casino Gaming Magazine*, February 1986, 48.

⁵³ Mike Lestrange, systems manager for Bally’s Park Place quoted in “Bally Expands Its Slot Data System” *Casino Gaming Magazine*, February 1986, 48.

of the first successful player tracking systems came from Electronic Display Technology (EDT) a subsidiary of the IGT, the new leader on the gaming devices market. In 1985, the concept first came to fruition at Harrah's Marina in Atlantic City, where the system connected 375 machines,⁵⁴ and later in the year at Tropicana in Las Vegas, with 637 participating slots.⁵⁵ Player tracking was in fact a supplementary feature of the slot system. While it used the same hardware, it was installed as an option depending upon the decision of the casino's management.

The slot player tracking system emulated long existing practices in retailing and other businesses that relied on the loyalty of their customers. Computer technology only simplified the paperwork and added accuracy to the basic principles known since the late 19th century. The new institutional structure that casinos put in place was the "slot players' club," a commercial entity promoted to the public with the promise of rewarding good gamblers. In 1985, in just a few months after inaugurating the system, Harrah's Marina in Atlantic City managed to enroll 15,000 people in the "Captain's Circle Club." Members of the club "are given [personalized magnetic stripe] cards, which they insert [in the machine] at the beginning of the play. The system then monitors coin-in, awarding the player a point as the coin-in reaches a predetermined plateau."⁵⁶ Points accumulated could later buy items as diverse as coffee mugs, barbecue utensils, fur coats, Rolex watches, meals, show tickets, and parking time at the gift shops, restaurants, hotels, and other amenities on a certain property. An endless variety of rewards and promotions became available, to lure and pamper, both the penny and high-end slot player. A 1985 EDT advertisement eloquently summarized the ability of the player tracking system to put a face on the previous anonymous slot player, "What do you mean you don't recognize her?

⁵⁴ "IGT: The King of Video Poker Expands Its Product Line" *Casino Gaming Magazine*, May 1985, 62 and "EDT's Player Tracking System Proves Its Worth" *Casino Gaming Magazine*, November 1985, 61.

⁵⁵ IGT: The King of Video Poker Expands Its Product Line, *Casino Gaming Magazine*, May 1985, 62.

⁵⁶ Ibid. 44.

She's your Star Player. The one who loves to play slots, and plays often where she feels luckiest and most welcome. The problem is finding her. Or him. How do you scan a crowded casino floor and locate your best player?"⁵⁷



Figure 5-EDT advertisement. *Gaming & Wagering Business*, May 1987, p.25.

In addition to its promotional appeal, the player tracking system had the huge potential of improving the casino's bottom line by enabling managers to gather information about the market. The network of slot machines and the player tracking system served as a highly effective and far-reaching market research tool whose capabilities kept expanding just as fast as the customer base of casinos. In fact, the system's growing complexity followed the swift reaction from casinos, as a project manager recalled. "[The system] is a constantly evolving product, and it will continue to evolve. The casinos themselves promote this: they come up with these super ideas and if we [the manufacturer] think they are good, we go ahead and implement them. There is a constant feedback from our customers."⁵⁸ The popularity of the player tracking system with casinos exceeded even the manufacturers' expectations, boosting the profits from not only slot machines

⁵⁷ "What do you mean" advertisement, *Gaming & Wagering Business*, May 1987, 25.

⁵⁸ Jeff Krintzman, SDS project manager quoted in "Bally Expands Its Slot Data System" *Casino Gaming Magazine*, February 1986, 48.

but almost every revenue-generating casino department. “It’s not the nicety of someone having a card,” pointed out an Atlantic City casino manager “I can virtually tell you what bus that person came on, where he lives, what he does, how much he plays... I can target the market from that point. We know exactly how many dollars or quarters were put in, and then can define from a marketing standpoint who they are, where they come from and what makes them tick.”⁵⁹ This extensive knowledge of a customer’s playing habits and demographics (“including his wife and kids” as an executive bluntly put it) channeled the energy of the marketing staff towards tailoring special programs of high appeal (slot tournaments, discounts, receptions, shows) to precisely targeted audiences. On the other hand, player tracking systems furnished exact and detailed data to the managers interested in rewarding players based on their performance and avoiding the abuse of complimentary services. In a lecture delivered at the annual New Jersey Society of Certified Public Accountants in 1985, the vice-president of Bally’s Park Place observed that comps were the second largest expense in most casinos, behind personnel costs, and that “‘knowing’ a player” was a strategic advantage on which the success of a casino depended. This top executive also urged managers to be objective in granting comps and emphasized the importance of developing algorithms for evaluating individual players’ win potential and maintaining databases for easy access and reference, a direction of development that player tracking system adopted in the following years.⁶⁰

The advent of computerized machines and systems did not bring an end to cheating, as one might think based on the claims made by the manufacturers who boasted 100% cheat-proof products. While old cheating schemes such as counterfeit coins or duplicate keys still existed, a

⁵⁹ Davidson quoted in “Showboat” *Casino Gaming Magazine*, July 1985, 54.

⁶⁰ Dan Macomber quoted in “‘Knowing ‘the player can be a comp key’” *Gaming and Wagering Business*, January 1985, 45.

hi-tech tampering business emerged with the new generation of “whiz kids” and kept their one-step-ahead advantage over the sophisticated technology. Tools such as the “monkey paw” and the “light device” were two typical examples in the cheaters’ new arsenal and aimed at rigging machines’ payoff mechanism.⁶¹ Paradoxically, the computer chip, which had replaced the most vulnerable parts of the machine to increase its security, raised most of the public and regulators’ doubts.

“Even to the technologically unsophisticated layman, it is obvious that any device that determines the winner by a computer is only as reliable as the people who design, install, and maintain it.(...) The introduction of solid state electronics and computerized microprocessor units to the gaming industry represents a tremendous technological advancement and has already resulted in increased revenues for gaming operators and their perspective taxing authorities. The other side of the coin, however, is the potential abuse of these products if unapproved devices are introduced to the industry or if unscrupulous people gain access to the microprocessor units.”⁶²

A cheating scenario imagined by a regulatory official incriminated organized crime, which by the means of “healthy bribes” could convince programmers to code the machines to their advantage. Later on, in the mid 1990s, even regulators joined the circle of suspects after a former engineer for the Nevada Gaming Control Board used his extensive computer knowledge to gaff chips and steal hundreds of thousands of dollars from casinos in Las Vegas and Atlantic City, in one of the most successful scams in casino history.⁶³

The fight against cheaters involved an intricate combination of actors and relationships, as manufactures, casino staff, and players could all interfere with the fair functioning of digital slot machines. Therefore regulators had to design measures to keep everybody in check. But to

⁶¹ George L. Lewis Jr., *Casino Surveillance: The Eye That Never Blinks* (G & G Surveillance Specialists Inc., 1996), 50.

⁶² A.J. “Bud” Hicks, “What’s in A Slot?” *Gaming and Wagering Business*, December 1984, 47.

⁶³ See chapter “A Cheater in Our Midst. Gaming Board Computer Whiz Ron Harris Beats the System” in Jeff Burbank, *License to Steal. Nevada’s Gaming Control System in the Megaresort Age*” (Las Vegas: University of Nevada Press, 2000).

that end, as slot machines became more sophisticated, they had to make sure that their technical expertise was at least on par, if not superior, to that of the manufacturers. Although the Nevada Gaming Control Board hired computer experts to examine and certify the digital components of slot machines since the late 1970s, a separate department concerned with technology, the Electronic Services Division, was founded only in 1987 to test and recommend gaming devices for approval by the Board as well as inspect slot machines in casinos, help with the casino-gambler disputes, and manage the Board's information management system. Specific rules concerning the minimum standards for computerized gaming machines were passed in 1989, to update the provisions of the Board's Regulation 14.⁶⁴ Up to this moment, the law lagged behind the technology for reasons enounced by the Board's members themselves "One reason for this occurrence is the ever-changing technology in this field. In the past, a regulation draft would be circulated, and before it could be adopted, technology would make the draft obsolete."⁶⁵ Some of the aspects covered by these rules included the devices' mechanical and electrical reliability, security against tampering, microprocessor accuracy, and the ability to perform certain accounting functions as well as player understandability and acceptance of the game.⁶⁶

The passing of the rules was precipitated by events that occurred a year before, in 1988, when the Board realized that manufacturers took too far their technical creativity towards boosting the popularity of their machines. In just three years from its arrival to the U.S., Universal Company Ltd. from Japan secured the biggest portion of the Nevada market, surpassing the long established giants of the industry, Bally and IGT. The objections raised by

⁶⁴ Regulation of the Nevada Gaming Control Commission and State Gaming Control Board available at http://gaming.nv.gov/stats_regs.htm#regs (accessed May 6, 2009).

⁶⁵ Nevada State Gaming Control Board, memorandum to the Nevada Gaming Commission, Regulation 14, Amendments, July 13, 1989, 1-2, quoted in Jeff Burbank, *License to Steal. Nevada's Gaming Control System in the Megaresort Age* (Las Vegas: University of Nevada Press, 2000), 107.

⁶⁶ A.J. "Bud" Hicks, "What's in A Slot?" *Gaming and Wagering Business*, December 1984, 11.

the latter drew the attention of the Board to the “near-miss” feature of the Japanese slot machines, a “wondrous combination of high technology, marketing ingenuity, and human psychology, with perhaps a smidgen of greed thrown in,” as an outside observer described it.⁶⁷ The “near-miss” concept referred to losing combinations, where the computer program stopped the reels in positions that misled the player to think that they were very close to hitting the jackpot. At the hearings, the attorney for Universal described the alignment of winning symbols just above or below the pay line as a gimmick similar to what already existed “in one form or another” in all slot machines and that the play was randomly determined and in accordance with the state standards. The Board ruled against Universal’s petition and required the company to eliminate the near-miss feature from all its 11,000 machines in Nevada. This episode, which irreversibly affected Universal’s supremacy in the U.S., brought to the fore the importance of keeping the legislation aligned to the fast pace changing technology.⁶⁸

The Division of Gaming Enforcement (DGE) in New Jersey also established a laboratory staffed with top engineers and technicians, who addressed the security issues raised by the host of microprocessors and systems in the market in a pro-active manner. ”We’re not saying we have absolute control,” said the New Jersey DGE Deputy Attorney in 1985, “We’re not naïve enough to say that. But we feel that we have the mechanisms in place here to identify problems earlier, and we should have a relatively high confidence level that what we are approving is what is actually being played on the casino floor.”⁶⁹ New Jersey legislators, and later those in Nevada, certified new slots in a two-step process consisting of the examination of the prototype machines

⁶⁷ Nelson Rose “Nevada Draws the Line at Near-Miss Slots” *Casino Journal*, July 1989, 51.

⁶⁸ Jeff Burbank, *License to Steal. Nevada’s Gaming Control System in the Megaresort Age*” (Las Vegas: University of Nevada Press, 2000), 104-127.

⁶⁹ Frederic Gushin quoted in “DGE Slot Testing Assures Integrity in New Jersey” *Casino Gaming Magazine*, May 1985, 31.

before approval for casino use and the testing of the microchip of every machine to go on the floor to ensure that the programs and information stored on them was the same with that on the prototype chip. Special comparitor equipment allowed for the identification of hidden programs as well as the testing of all subprograms and functioning phases.⁷⁰ The supervision of the machines by the Board continued after their placement in casinos, with teams of agents randomly inspecting the chips in the field for irregularities.⁷¹

VI. Back to the Player: Designing Slot Machines with Customers in Mind

The late 1980s marked the beginning of an unprecedeted period of growth for casinos in the United States. Counting on legalized gaming as a viable source of economic development, Native American tribes pushed for the passing of the 1988 Indian Gaming Regulatory Act, which established individual tribes as primary regulators to define the basic framework for gaming on reservations. During the next decade, Native American casinos opened throughout the country, from Connecticut (with its Foxwood Casino, the biggest casino in the world, founded by the Mashantucket Pequot tribe) and New York to California and New Mexico. The interest in legalizing gaming also stormed the heartland. By 1999 six states in the Mid West and South (Iowa, Illinois, Indiana, Louisiana, Missouri, and Mississippi) adopted riverboat casinos, in an attempt to tap into the local interest in gambling but limit the perceived social problems associated with full-fledged casinos. Other jurisdictions in Colorado and South Dakota also embraced limited casino development. At the same time, Atlantic City continued to grow in terms of gaming-generated profits and Las Vegas inaugurated the megaresort decade. One after another, gargantuan properties replaced the legendary casinos of the past that were demolished in

⁷⁰ “DGE Slot Testing Assures Integrity in New Jersey” *Casino Gaming Magazine*, May 1985, 30.

⁷¹ Anthony Parrillo “Combating Casino Crime”, *Casino Gaming Magazine*, April 1988, 26-27.

spectacular implosions. On the Strip, Mirage, the trend-setter, inaugurated in 1989 with 29 stories and 3,049 hotel rooms, was soon to be surpassed by Excalibur, Luxor, Treasure Island, and many others, all of them raising the bar in terms of size, originality, and lavish architecture and interior design. Legalized gambling was certainly “on a roll in America” as a prominent casino president and CEO noticed.⁷² With new gaming facilities mushrooming all over place, the industry entered a time of intense competition to which gaming operators responded with mergers and consolidations as well as aggressive marketing and increased reliance on technology. The slot machine entered the 1990s as the center of attention on the casino floor and maintained this privileged status throughout the entire decade.

The breakthrough inventions of the 1970s and 1980s transformed the slot machine into a product with a dual role. First, slot machines functioned as devices in their own right, which enjoyed appealing looks and high jackpots. While the old format of the steel box with spinning reels was still recognizable behind the computer-generated flashy visual effects and clinging bells, the digital guts conferred machines improved security, reliability, and accountability. On the other hand, as a self-contained micro-computer, the digital slot machine became the basic element of the casino data highway, a vital information system that provided casino operators with the means to control and streamline the activity of all the machines and related staff on the casino floor. The system had crucial ramifications in the area of regulation, as every aspect of the machine could be monitored and checked for compliance with the law. By and large, in the 1990s, the designers of gaming technology chose to expand the existing capabilities rather than insist on revolutionary concepts and formats, thus guiding the slot machine and the related systems through a maturation phase that would continue well into the new millennium.

⁷² Philip G. Satre “Gaming Remains Good Bet” *Casino Journal*, February 1990, 34-35.

Increasingly, the voices of the manufacturers and casino operators signaled a departure from their early concerns with the basic flaws of the device, cheat-proofing, and cumbersome maintenance. The cut-throat competition for customers catalyzed a paradigm shift in the primary role that the machine was supposed to play, bringing its end users -- the gamblers -- and their expectations to the foreground. In other words, once the machine became reliable, predictable, and profitable by the simple fact of being played, the attention of designers shifted to maximizing the device's potential to attract and retain gamblers.

“What makes a slot machine a popular game?” was the question of the day and the variety of answers it elicited outlined the ideal device of the 1990s as the marriage between “old-style gambling” and enhanced fun. Speaking on behalf of their customers, some slot managers argued for the always appealing casino attraction: money. “You’ve got to send away winners to have players. And people don’t go home talking about how often they hit cherries. They talk about jackpots.”⁷³ “More time on the machine,” said other casino professionals, That’s what they [the players] want – a bigger bang for their bucks.”⁷⁴ Other insiders asked for more interactivity, giving players the perception that they have the upper hand in determining the outcome of the game. Gradually, the perceived value of the gaming experience by the player came to be put on par with that of winnings, “They [the players] are looking out to be entertained. It’s not only the adrenaline rush of winning. It’s the rush of being involved in a winning experience.”⁷⁵ The late

⁷³ Jim Gutke, slot director for Players International, quoted in Peter Carlin “The Art of the Hold. The Secretive World of Slot Hold” *Casino Executive*, October 1995, 62.

⁷⁴ Skip Camp, executive director of slot operations at Trump’s Castle, quoted in Mike Epifanio “Slots by the Sea. Atlantic City’s Most Popular Slot Machines” *Casino Player*, August 1994, 30-31.

⁷⁵ Randy Adams, game developer for Anchor’s Gaming, quoted in Dave Palermo “Randy Adams. Anchor Gaming’s Creative Force Lays Waste to the Industry’s Common Wisdom” *Casino Executive*, September 1995, 24.

20th century slot machine cashed in on “the coincidence of desire and design,” as an anthropologist observed.⁷⁶

While most manufacturers and operators agreed on the importance that the jackpot held in the machine’s overall player appeal, different opinions and approaches surfaced as far as the impact of the jackpot size on gamblers. Were bigger and seldom hit jackpots more alluring than smaller and more often ones? The answer was rather a grey area and successful strategies came from both sides, as the digital technology employed in the machines allowed for a virtually unlimited range of possibilities.

IGD devised one of the first successful strategies in the mid-1980s, as the clever variation of a persistent theme in the development of slots, the combination of more machines within the same property⁷⁷ for a cumulative (and considerably higher) jackpot. The first inter-casino link progressive slot system, called Megabucks, debuted at the Stardust Hotel & Casino in Las Vegas in March 1986.⁷⁸ The system used regular telephone lines to connect dollar video slots in carousels⁷⁹ at casinos across Nevada. In fact, Megabucks was the outgrowth of another product that IGT had prepared for the expected legalization of the video lottery in Nebraska, which failed, so the technology was adapted for wide-area progressive (WAP) use.⁸⁰ Megabucks lottery-style jackpots easily and quickly reached amounts in the range of several million dollars, with every coin that was going in every machine and every casino participating in the system. Peter Dickinson, the head of the engineering team in charge with the project, connected all the machines at all locations to a central computer at the IGT headquarters in Reno, which collected

⁷⁶ Natasha Dow Schull “Digital Gambling: The Coincidence of Desire and Design” *The Annals of the American Academy of Political and Social Science*, 597, January 2005, 65-81.

⁷⁷ Also called local-area progressives (LAP) systems

⁷⁸ “IGT and Stardust Kick Off Nevada Megabucks” *Casino Gaming Magazine*, August 1986, 52-53.

⁷⁹ Carousels are small batches of slot machines placed together on the casino floor and connected to a larger jackpot.

⁸⁰ Ernkvist, 194-195.

all the information and monitored the terminals 24/7.⁸¹ The first Megabucks winner, Terry Williams of Los Gatos, California, hit a \$4,988,842.14 jackpot in February 1987 in a widely promoted event that energized not only the video machines' and Megabucks popularity but also IGT's efforts to fine-tune the system's marketing strategy. "We need credibility. Credibility is something you have to earn and you earn it by making payouts. The theory is, we'd rather pay out ten \$1 million jackpots than one \$10 million jackpot,"⁸² said an IGT director, laying out the rationale for the later introduction of the "double-progressive" and "higher reset" features⁸³ and the adaption of the Megabucks principles to machines of different denominations (Quartermania, Nevada Nickels) and themes (Fabulous '50s, Pokermania, High Roller).

As Megabucks and its related successors made great strides in the market, critics voiced loud concerns. "We've traded the excitement of frequent jackpots for machines with a nice even keel. That's the problem. We have taken the volatility out of these machines, which means no one is winning these jackpots on a regular basis," argued a machine designer.⁸⁴ However, smaller and more frequent payouts remained within the realm of performance of every individual (not networked) machine and, ultimately, an attainable objective for each casino, provided that the customers played that particular machine. Therefore, to draw crowds, increasing efforts by both manufacturers and casinos focused on improving the looks of the machine and its entertainment value. As an engineer noticed, machine appearance and playing appeal were two closely connected driving forces for designers, "One grabbing that first quarter [from the player].

⁸¹ Charles Mathweson, CEO of IGT, interviewed in *Casino Journal*, May 1990, 32.

⁸² "IGT Revises Megabucks, Fine-Tunes Marketing Strategy to Capture Megasales" *Casino Gaming Magazine*, August 1987, 20-21.

⁸³ A double-progressive system has two simultaneously growing jackpots of different amounts, to increase the odds of winning smaller prizes. The "higher-reset" feature refers to the minimum amount to which the jackpot returns after being hit to avoid situations where players would not play the machines due to too small of a jackpot.

⁸⁴ Randy Adams, director of game design, development, and sales for Anchor Game, quoted in "Gamesmanship. The Stakes Are High as the Industry's Game Producers Try to Forecast the Future" *Casino Executive*, September 1995, 26.

The machine has to be attractive, and a lot of that is the glass, the colors, the art work, etc. Two, keep the entertainment value there, so the player stays. This is the software.”⁸⁵

As far as the appearance of the machine, in the 1990s, the theme craze that turned the Las Vegas Strip into an eclectic collection of properties showcasing replicas of Venetian canals, Egyptian tombs, and 17th century buccaneer ships, offered slot managers a wealth of new and creative resources for individualizing their devices. In some cases, enhancements consisted of branding off-the-shelf and already successful machines, in an attempt to differentiate a casino’s machines from those of the competition. The MGM Grand Hotel & Casino in Las Vegas incorporated astrological motifs in the glass design of a group of IGT slot machines, to create the “Star Struck” section, while Caesars Palace opted for “Fountain of Fortune”, “Roman Rewards” and “Caesars Gold” packaging. Quite often, the whole floor received a facelift to match the slots, as it was “The Big Picture” section at MGM, a movie theatre setting with rows of machines in front of a screen showing spinning coins that turned according to the amount of play at the machines.⁸⁶ Some casinos opted for proprietary games that were developed from scratch, based on specific requirements, while others simply resisted the theme trend, perceiving it as a waste because “the manufacturers, the IGTs and Ballys, spend a lot of dollars marketing their products. To take a Double Diamonds⁸⁷ and call it something else, or just graphically change the presentation of the game is not good business because the customer has never seen it and can’t identify with it.”⁸⁸ Another direction of theme development borrowed popular content such as shows (Jeopardy, Monopoly, and Prime Time), movies (Indiana Jones and Star Track) and even

⁸⁵ Ray Heidel, game designer for Bally Gaming quoted in William J. Dorn “Tech lessons. The Technology Revolution Marks the Dawn of a New Era” *Casino Executive*, June 1995, 12-13.

⁸⁶ John Edwards “The Theme Scheme” *International Gaming & Wagering Business*, November 1997, 40-43.

⁸⁷ One of the most successful IGT machines in the 1990s.

⁸⁸ Todd Simons, former slot director at Circus Circus Las Vegas quoted in “Slot Manager Forum” *International Gaming & Wagering Business*, November 1987, 54.

music stars (“Let Elvis Rock Your Reels” sounded the slogan of an IGT product) from other media (TV, motion pictures, and music). These products benefited from advanced developments in sound technology. Music, spoken messages, and pre-recorded sound effects augmented the content of a themed game, giving properties more leverage in the effort to differentiate themselves from the competition.

Improving the entertainment value of the machine relied on a diversity of schemes meant to capture and retain the customers’ interest and give the gamblers the satisfaction that the, even without winning the jackpot, the playing experience was worth the money they dropped into the slot. In 1994, Bally advanced Game-Maker, a new idea putting forth the option of playing multiple games (usually 7-8) on the same video device. The multi-touch screen of the machine displaying the icons of the available choices gave the concept of inter-activity a new dimension of concision and simplicity. Instead of looking for a different machine on the casino floor, everything a player willing to switch to a different game had to do was to access the root menu on the monitor and select the preferred theme. The success of Game Maker, which displaced about five percent of the video machine inventory in Nevada in the first year following its launching, rewarded the meticulous R & D and testing process undertaken by Bally. Although tempting, the possibility to create a machine with too many options had to be rebutted by engineers, worried that the learning curve would be too steep for the players. “We offered too many games, too many options, too many features,” explained a designer, “It was confusing and complex. So we continued to refine the product to get it down to what was acceptable to the player. We continually evolved, modified, re-did, re-thought, re-programmed, and re-tested. We

were conscious that people don't come to Las Vegas to learn. They come to have fun.”⁸⁹ Other manufacturers remained faithful to the basic principle of the standard three-reel machine, while teasing out new possibilities to increase its appeal with bonus games, events, and features. The epitome of this breed of gaming equipment, Wheel of Gold, came from Anchor Gaming and swept the market beginning in 1996. The landing of a certain symbol on the one of the reels on the pay line gave the player the option to spin for cash a back –lit three dimensional wheel placed on the top of the machine. Not only did the over-sized top wheel enhance the overall kinetic look of the device, but it also meant to crack the individualistic aspects of slot playing, by encouraging the interaction among the players using similar adjacent machines. As one of the designers of the machines recalled, “ (...) when these games are in groups, someone in this game-show environment you've created is spinning for cash. They know they've won, they just don't know what.”⁹⁰

The competitive business environment of the late 1980s and 1990s, wherein casino managers sought to maximize the slot machines' profitability, directed engineers' technical creativity towards approaching the problems associated with the use of cash in slot machines from a different perspective. Instead of improving the existing coin-related features of the device (i.e. acceptors, hoppers) some designers began looking for alternatives to the coins themselves, namely bills and, eventually, “virtual money” (credit/debit cards). Bill acceptors integrated within slot machines were the prelude to cashless machines. Players inserted bills to buy “credits” (games) or cash out coins without leaving the machine or waiting for a change person. Not only did this simple and fast process increase the play time per device but it also improved

⁸⁹ Raymond Heidel, Vice-President Engineering of Bally Gaming quoted in William J. Dorn “Tech Lessons. The Technology Revolution Marks the Dawn of A New Era” *Casino Executive*, June 1995, 12.

⁹⁰ Randy Adams quoted in Frank Legato “Slots World” *Casino Journal*, October 1996, 73.

personal service in the casinos where slot representatives (a new job title for the former change attendants) could dedicate their time to hosting functions. On the same positive side, business and technical analysts also noticed that the bill acceptors helped slot players keep the score of their game and devise money management strategies.⁹¹ Bill acceptors came to the U.S. from Japan, via JCM American Corporation and its president, Aki Isoi, internationally known as “the father of the bill validator.”⁹² After signing a far-reaching contract with International Gaming Technology 1990, JCM rose to a leading position among coin-and-currency-handling systems manufacturers, claiming 95% of the bill validating market. By 1998, embedded bill acceptors turned into a standard feature of the slot machine, generating a 30% average increase in the coins-in per device.⁹³

During the 1990s, aiming at providing more convenience to costumers and increasing casinos’ bottom-line, designers focused on the complete elimination of cash from the use of slot machines. Although tempting, given its potential to cut back payroll expenses and coin jams, the revolutionary “cashless machine” concept met strong resistance initially. Opponents voiced concerns that credit gaming could lead to over-indulgent playing and mounting personal debts and create possibilities for money laundering and cheating. On the side of the casino management some critics pointed out that a slot area served by only few staff members deprived players of human contact and the associated courtesy, with negative consequences on the casino profits. Others pointed out that the elimination of coins dropping in the tray could act as a psychological turn off for gamblers used to link the metallic clatter with the “looseness” of the

⁹¹ Little Joe Lansky “Keeping Score. Bill Acceptors Offer a Hidden Advantage” *Casino Gaming Magazine*, October 1993, 14.

⁹² Rex Buntain “Validated” *Casino Executive Magazine*, September 1997, 122.

⁹³ Joseph Pitito director of investor relations for Global Payment Technologies quoted in Dan Emerson “Virtual Money” *Casino Executive Magazine*, January 1998, 31.

machine. “The customer likes to get his hands dirty, feel the coin and put the money in his pocket. (...) With a credit card the customer isn’t going to have any fun playing a slot machine,” recalled a slot director pondering the possibility of adopting cashless devices.⁹⁴ Experiments with cashless machines began as early as 1993, when MGM Grand tested 350 coin-free slots in Las Vegas but the wide adoption of the technology would have to wait another decade.⁹⁵

The transformation of the mechanical slot machine into a multi-faceted digital device shaped and was shaped by the complex historical context in which this gambling technology was designed, manufactured, and used. Set on the path of change because of its own liabilities – mechanical unreliability, susceptibility to cheating, and cumbersome control – the slot machine went through a network of institutional and individual mediators who threw into question the old assumptions about the device and recalibrated it so as to fit their convergent agendas pertaining to gaming control, business profitability, and customer appeal. The story of the innovations that marked the rise to prominence of the most popular casino machine today echoes the larger narrative of growing fascination with gambling by the public at large, corporate competition for the expanding market, and governmental efforts to regulate this growth.

⁹⁴ Ken Maple slot director for the Boyd Group quoted in “Cashless Slot Machines: The Industry’s View” *Casino Gaming Magazine*, August 1985, 11

⁹⁵ Dan Emerson “Will Cashless Be King. Casino Gambling Debates a Future without Bills and Coins” *Casino Executive*, October 1998, 34.