XIV International Economic History Congress, Helsinki 2006

Session 45

Down Many Times, but Still Playing the Game

Creative Destruction and Industry Crashes in the Early Video Game Industry 1971-1986[1]

Mirko Ernkvist

Introduction

The early, formative years of many industries is often wrapped in a mist of mystery in which meagre information and highly exaggerated stories give ways for historically grounded accounts of industry dynamics. That has also been the case for the video game industry in which many, often contradictory factors has been put forward as explanations of what many regards is the most extraordinary event in the history of video games, the 1983 crash. The event forced a majority of the U.S. video game companies out of business and was accompanied by a subsequent change of industrial leadership from the U.S. to Japan. In the U.S. and Europe the event is usually referred to as "the 1983 video game crash' or simply "the video game crash', while in Japan it is referred to as "the Atari shock' (a name that emphasise the unexpectedness of the event and the downfall of the dominating video game company of that time).

In general, seven explanations of the crash has been out forward. Early explanations that emphasized that the 1983 video game crash was the result of (1) the end of a teenage-fad (Friedrich 1983) where accompanied by explanations that highlighted (2) the mismanagement of a single firm, Atari (Cohen 1984), (3) the social critique that video games as a medium received (Williams 2004), (4) overproduction of the number of games produced and price competition (Cambell-Kelly 2003), (5) the market failure of some notable major games (Kent 2001) , (6) saturation of the market for home console systems (Cambell-Kelly 2003) and (7) the introduction of a new platform for playing games, the home computer (Cambell-Kelly 2003, Herman 2001). Some of these explanations do not exclude each other and they are referred to in the literature without any further, exhaustive explanation and little empirical research of the events that lead to the crash.

Despite the familiarity of the 1983 crash, no study has elaborated further on the fact that crashes and shake outs was a recurrent structural phenomena of the video game industry during its first 15 years with a number of severe crashes or major firm shake outs occurring in every game platform after short periods of high growth. Subsequently, from the end of the 1980s and onward, the video game industry entered a relatively more stable period without the same turbulence on an aggregated level as before.

This paper reassess existing explanations of the 1983 crash and instead gives a consistent structural explanation of the turbulence that characterized the first 15 years of the video game industry, arguing that all early crashes and shake outs shared similar structural characteristics. Without such an explanation, detached and limited explanations of the dynamics (such as those seven mentioned above) will be nothing more than just the icing of the cake.

Method

This paper present a long term historical account of the video game industry where all early crashes and shake outs in the period 1972-1985 are compared and contrasted, when possible using the whole population of firms active in the market for various game platforms. Two

[1] I am grateful to Jan Jörnmark for his helpful comments on various versions of the manuscript..

crashes and two major shakeouts are covered: the arcade shake-out of 1975, the dedicated console crash of 1977, the 1982 shake-out of arcades and the programmable console crash of 1983.

The term 'video games' in this paper refer to all forms of electronic games on various platforms (arcade, consoles, PC, handhelds etc.) unless otherwise is stated. The term 'industry crash' refer to an event in which the majority of the firms in an industry exit in a short time period (one or a few years) and the overall market for the industry is greatly reduced or eliminated during that period. The term 'shake-out' refer to a less dramatic event than an industry crash in which a large number of firms in an industry exit an industry within a period of a number of years and the decline in the industry (if any) is less rapid and steep than for a crash.

Research Questions

This paper addresses the following main question:
Was there a structural dynamics behind the turbulent period of crashes and shake-outs in the video game industry during 1972-1986?
This question is then related to other:
If so, which factors where the primary driver behind this structural dynamics of crashes and shake-outs?
Were firm exits a necessary structural adjustment to new market condition and a prerequisite for further growth in the industry?

Video game industry and firm failures

Firm failures could be depicted in many ways; this paper will concentrate on firm exit an industry which in the video game industry in many cases led to firm ending their business and in some cases to insolvency and/or bankruptcy. It could be argued if firm exit is a good indication of a failure since there may be other motives behind exits than that of a perceived failure in the market (for example ventures into other or new more profitable industries). However, the detrimental and severe effects of the crashes in the video game industry make such claims less relevant in this context. Moreover, it could be argued that in a high-tech industry such as video games which have a highly demanding manufacturing and development practices, a reorientation by a firm towards other types of products would be such a major transition that it would be impossible to call it the same firm.

Other problems emerge for studies connecting firm failures with other types of measures such as bankruptcy and insolvency. Each measure represent different sub processes and are connected differently in both time and meaning to the concept of firm failure and thus varies in explanatory stringency depending of what kind of process related to failure we are interested in studying (Carroll and Hannan 1995; Hannan and Carrol 1992).

One of the benefit with using firm exit statistics as a measure of firm failure is that it is closer in time to the actual process that led to the failure by a firm in a certain industry than for example bankruptcy which may occur a long time after the a firm has actually been involved in the market. By using firm exits statistics rather than bankruptcy statistics there is better opportunities to study how the changing structural conditions in a certain industry impacts the population of firms active in it. This increases the opportunity to study the impact of industry wide structural events such as "creative destruction' which in some studies have been difficult to relate to the occurrence of bankruptcies (see e.g. Grazer and Sjögren 1999).

In the literature trying to explain firm failures, two major perspectives dominate. Firm internal perspectives often put forward the crucial role of management inefficiency, while firm-external perspectives put forward the role of a number of changes in political, technological, social or economic factors outside the control of the firm. Both stances take an opposite view of the old, but still disputed question of the degree of the manager's ability to affect the success or failure of the firm in periods of changing market conditions. Organizational ecology and many

strands of strategic management are two examples of research schools that stand on the opposite side of this spectrum. However, as pointed out (Lindgren 1999), both stances do not exclude each other and studies which combine industry wide dynamics with qualitative studies firms involved have the potential to shed some light on the interaction of selection by firm external structural factors and firms abilities to dynamically change their capabilities (Dosi et al. 2001).
To understand the factors behind industry crashes and firm failures in the video game industry, the specific growth dynamics of industry must first be elaborated.

Entertainment Industries and Video Games

Innovations in the form of new experiences are the backbone of most entertainments. More traditional entertainment such as music, movies, television, gambling, comic books, pinball, and theme parks has always to a high degree been dependent on the constant introduction of new experiences (Vogel, 2004). Video games as an entertainment form is especially characterized by this constant urge for new variation of player experiences ant it is more closely connected to the exponential progress in digital technologies than most other entertainment industries. Throughout history, video games has always been able to use what new hardware has offered in terms of storage, processing and network capacity and transform it into new player innovations.
This exponential trend in digital technologies had also brought with it an increased complexity of video games and their development process.

Similar to other entertainment, video games also competes for consumers' free time. This enables opportunities for growth as every moment of a consumers' life outside the actual work is a potential market for entertainment consumption. However, this free time is highly competitive and to a certain degree video games do not only compete against other video games but against every other type of entertainment available. If one entertainment form by any reason stagnates, there is a risk is that another form of entertainment is ready to step in and take its place among consumers.

The uncertainties over demand that characterizes a number of entertainment industries (Vogel, 2004) is also characterizing of the video game industry in which past successes to a limited degree can explain or be the receipt for future success.

Literally born out of the transistor logic and digital both in the production and exhibition stage video games has had a unique ability to evolve and diversify in accordance to the fast evolution and constant new disruptive technologies that have characterized digital technology (Jörnmark et. al. 2005).Sine its inception, digital technologies has been subject for rapid, exponential trends of increased capacity. Most famous of these trends is Moore's law which in its most commonly described form stipulates that there will be a doubling of the processing capacity (for the same price) on every 18-24 months, which also indicate the halving of price for integrated circuits with a certain capacity during the same period (Moore 1965; Jörnmark et al 2005). Similar fast exponential trends have historically been common in many other digital technologies such as memory, storage and network technology.

For companies in the video game industry this dynamics have meant that they had to operate in an environment of constant innovations in which new hardware and software inexorably have driven earlier versions out of the market in a process of creative destruction (Schumpeter 1943). New disruptive S-curves have constantly emerged (Christensen 2003) which have made industrial leadership hard to sustain in the video game industry. New firms or firms from outside the industry have constantly built disruptive business models around new disruptive technologies that have had an advantage over inertia plagued incumbents (Jörnmark et al 2005). The fast technological development has made possible frequent opportunities for firms to reap Schumpeterian quasi rents through innovation, but the time period at which they could be used as a competitive advantage decreased. There are numerous examples of firms in the video game industry that have made huge profit in one year that have turned into a major loss the next. As a result, the rise and fall of firms have been extensive.

Video game crashes and 3D: (1) Disruptive technologies, (2) Delimited differentiation and (3) Decreased entry barriers and destructive liabilities of newness and smallness.

While this paper argues that *disruptive technologies* has been a major source for restructuring and firm failure in the video game industry, disruptive technologies by itself was a necessary, but not sufficient structural condition to create the industry wide crashes that within a short time forced a majority of the firms out of the market. It was only when disruptive technologies where accompanied by delimited abilities for firms to differentiate themselves from other firms, entry barriers decreased and the liability of newness and smallness was destructive for the industry that such extraordinary and widespread events as an industry crash occurred (see Figure 1). When some of these factors where less present, a lengthy shake-out and restructuring efforts among video game companies made the connection between creative destruction and firm failure less direct. However, this does not mean that the process of creative destruction was absent in those cases too as it could be instances of the less dramatic normal case in which the process "takes considerable time in revealing its true features and ultimate effects' (Schumpeter 1943, p 83). Industrial crashes are those rare cases in which the effect of creative destruction becomes compressed in time, where competition becomes cutthroat, restructuring efforts are critical and losses for firms that are of the magnitude that it is not possible to wait for better times by relying on strong financial resources.

In the following sections the impact of these 3D factors and their relation to the video game industry will be worked out in detail.

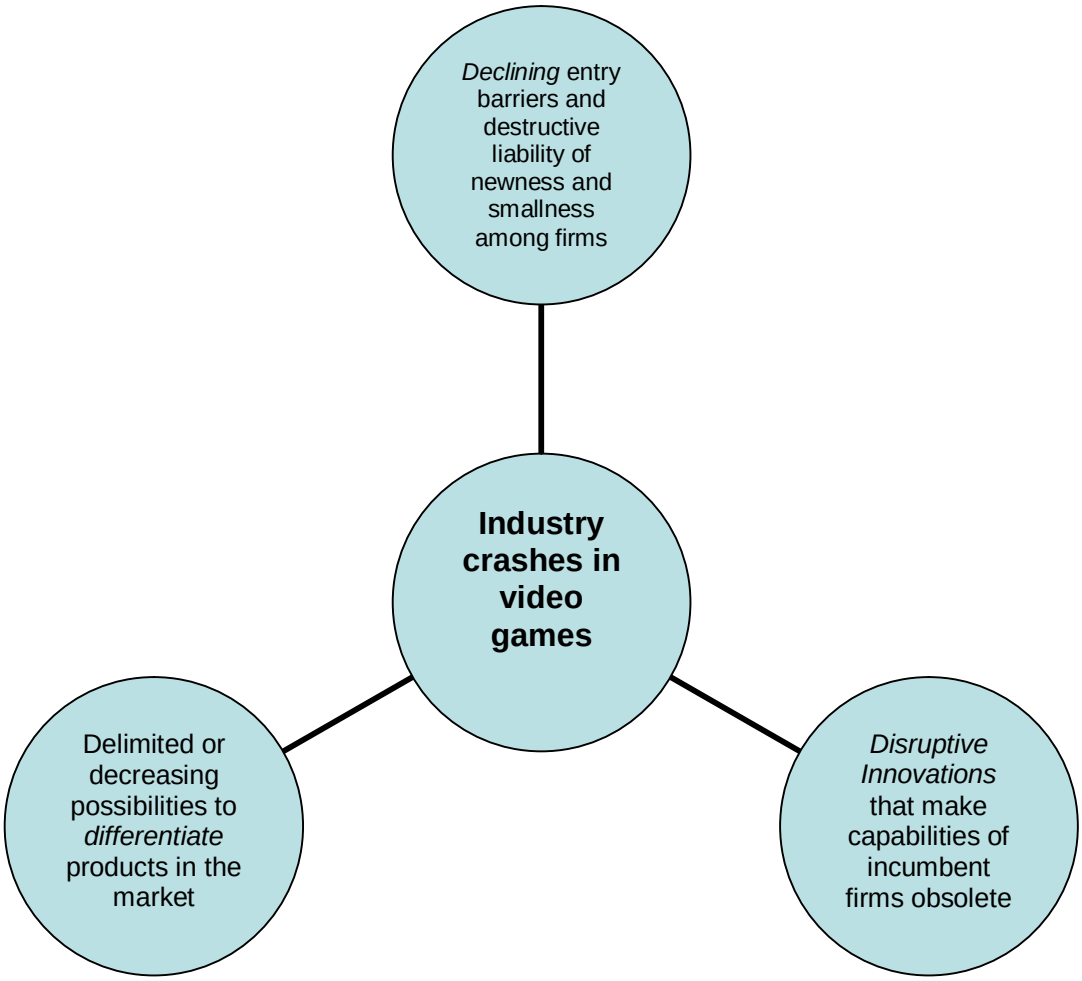


Figure 1: 3D factors which all in combination caused the video game crashes, and where factors behind industry shake-out when not all where present to the same degree.

Disruptive technologies

For Schumpeter, the relation between firm failure and creative destruction through innovation was explicit and straightforward. He argued that competition through innovation is the most important form that does not threaten the margins of firms' profit "but at their foundations and their very lives' (Schumpeter 1943, p. 84) and provide decisive costs or quality advantages. Although plausible, a number of problems occur when one ought to do empirical studies with this as an assumption. One is that the innovation process itself is so varied; there are numerous types of innovations in Schumpeter's definition of the term that are all of very different nature. When multiple forms of innovation are at work at the same time, the combined effects are far from straightforward. Another problem is that the entrepreneurial function in Schumpeter's later view was a function that could be carried out on multiple levels (the individual entrepreneur, firms etc.), making combined effects of multiple levels of analysis eligible.

One single type of innovation, technological innovation, has dominated the evolution of video games and it is mainly through new opportunities created by technology that new disruptive business models have been made possible (Jörnmark et al 2005). The simultaneous

rapid obsolescence of established business models have made it hard for many firms to adapt to the new circumstances.

In their study of the dynamics of technological innovations, Anderson and Tushman (1990) could show that in a number of industries radical innovation was often followed by a longer period of incremental innovations. They argued that these radical innovations, which they labelled technological discontinuities, could either be competence enhancing or competence destroying in relation to existing competencies and capabilities in the industry. Through struggles between rival designs, a dominant design then often emerge (Anderson and Tushman 1990).

Clayton Christensen (2003) has continued to study the effect of competence destroying innovations on business models. He could show how common it was for established leading firms to fail when new technological innovations are disruptive in the sense that they (1) create new growth opportunities, (2) attract customers away from the core of the mainstream market and (3) make it hard for incumbent firms to respond by developing a different value chain (Christiansen 2001). In the video game industry, disruptive technological innovations happened so frequently in the period under study that longer periods of incremental innovations was an exception, rather than a rule.

Delimited differentiation

One of the most remarkable features of the video game industry is how increasingly differentiated it has become in the last 30 years. This increased differentiation has not only affected products, but the distribution, marketing and service surrounding the products as well. Despite this, few have studied how this remarkable increase in differentiation relates to the growth dynamic of the video game industry. In this regard, the video game industry is far from the perfect market of homogenous products characterized by equilibrium that Schumpeter criticized as being only a special case, but a market in which firms though differentiation constantly creates special markets for themselves:

> "Each firm in any sector of the system in which monopolistic competition prevails offer products that differ in some way from the products of other firms in the sector, and thus supplies a special market on its own. This product differentiation must be interpreted with reference to its rationale, the creation of such a special market, hence very broadly: it comprises not only 'real' but also' putative' differences, not only differences in the product itself, but also differences in the services incident to supplying it (atmosphere and location of shops included) and every device that enables the buyer to associate the things he buys with the name of a particular firm.' Schumpeter (1939, p.63).

It is the ability of the video game industry to constantly break down boundaries to increased differentiation, both in terms of hardware (Jörnmark et. al. 2005) and software (Jörnmark and Ernkvist, 2004) that has been one of the major drivers for growth of the video game industry and the way it has escaped innovative lock-ins. However, this process of increased differentiation has not been smooth and even throughout history. In the early video game industry, there were fewer opportunities for firm to differentiate themselves from each other and technological lock-ins was common. The result was a turbulent period with rapidly changing patterns for possibilities of differentiation in which commoditization and crashes followed short periods of fast growth. Some platforms for games where better able to continue differentiation along with the fast pace of technological innovations and became the focus for the continuous innovative process of creative destruction.

Contemporary video games could be differentiated along a large number of dimensions, real as well as putative. In terms of product features there is differentiation in game hardware and game software. More putative differentiation exists in terms of brands, licences, distribution channels, and marketing. With such diversity, contemporary video games has been able to adapt

to a large number of different tastes and the diversity has increased the stability of the industry, but (as argued later) that was not always the case.

Decreased entry barriers and destructive liabilities of newness and smallness

Barriers to entry have shifted considerably in the early video game industry. The erratic pattern of entry barriers have been the result of the combined effects of two tendencies, (1) increasing development costs and complexity, and (2) degree of modularity of production.

***Increasing development costs and complexity*.** One side effect of Moore's law is the steady increasing development costs. As the processing capacity and the performance of other components have increased exponentially, the complexity of the production and development has resulted in increasing costs as well. This has been evident in both the hardware and software part of the industry. Integrated circuit components is the most expensive material parts in game consoles, accounting for over half of the material costs (iSuppli 2005), and for these parts R&D costs, testing, factory and equipment costs have increased considerable which only has been possible to carry through increasing economies of scale (Jones 2004). The same is true for game software in which the increased complexity has resulted in around a 4x increase in game development costs for each new generation of consoles. Simultaneously the number of persons involved in AAA game development projects have increased from one or a few people in the end of the 70s to today's teams of >50 persons. While the increasing development costs and complexity in hardware and software has increased entry barriers for new firms in the industry in the long run, sudden changes in the degree of modularity has rapidly decreased the entry barriers in certain parts of the value chain in the short run, making it possible for new firms to enter the industry.

***Degree of modularity*.** One common way to manage increased complexity is by grouping a complex process into a number of interacting subsystems, which has been labelled the decomposability principle (Garud et. al. 2003). The basic problems with the degree of decomposability of a system is the problems and costs associated with coordination (Garud et al 2003) The cost and advantages of different degrees of modularity did have an overwhelming impact on a number of video game firms because it created possibilities for a number of firms to enter the market in previously closed part of the value chain. Subsequently, the increasing development costs and complexity that followed Moore's law put pressure on a number of these new, small firms in the market.

From the beginning, video games was a system in which the complete design of hardware and software was related to such a degree that both operations where performed by the same video game firm (e.g. Magnavox and Atari), but then a number of changes in the degree of modularity made it possible for firms to enter certain parts of the value chain. The "pong in a chip', the programmable console and the home computer is all examples (described more in detail later) of changes in the degree of modularity that affected entrance barriers in the industry.

Apart from development costs and degree of modularity of the system, the financial market and the expectations surrounding video game as a phenomenon have affected entry barriers as well. The financial market and its growth projections of the video game industry fuelled the creation and growth of video game firms during some periods while it inhibited it in other periods. As argued later, the venture capital market in the US was important for the number of US game software firms entering the industry in the beginning of the 80s, and was also indirectly one important factor that made the effect of the video game crash of 1983 more severe in the US than in Europe and Japan.

Destructive liabilities of newness and smallness. Organizational researchers have studied the lower degrees of survival rate of new (Stinchcombe, 1965) and small firms (Aldrich, H et al. 1986;) in many industries. The liabilities of newness have been explained by several factors such as new firm's lack of trust, experiences, routines, fame, relationship, interaction and history to

support planning. For the liability of smallness, limited financial resources, human resources, skills, market presence and power had been put forward as factors of vulnerability.

When entry barriers decrease rapidly in an industry through the opening of previously closed part of the industry (e.g. by increased modularity), the demographic of new and small companies increase and many new entrances tend initially to be generalist firms rather than specialist firms (Aldrich 1999). A situation in which a large part of the industry contains firms that are both small and new is indeed a very fragile one that could be subject for a high degree of firm failure in times of more harsh business condition. The effect could be even more damaging if the withdrawal of firms does not lessen the competition for those firms left in the industry, but instead is destructive and worsen it by for example dumping prices through their effort to selling out their entire remaining stocks of products at discount rates. This is what happened during both video game crashes (1977, 1983), and as a result the market conditions became even harsher for the firms left in the industry in the short term.

Industrial crashes and shake-outs in the early video game industry

The 1975 arcade shakeout

Initially, many of the large established companies that made electromechanical pinballs and other amusement machines were reluctant to enter the electronic arcade market. Instead, two small California based companies, Nutting Associates and Computer Recreations was the first to enter the market in 1971, but due to a premature technology, poor understanding of the market and unsuccessful game concepts, both endeavours failed to be successful. However, one year later a former Nutting Associates engineer, Nolan Bushnell co-founded Atari and took the simple Pong concept to the arcade. With its simple but enticing game play it became an immediate success in the end of 1972. Pong was a true disruptive technology in relation to pinball and other electromechanical games. It earned more money, required less service and the development process was different. At the time of its breakthrough the electromechanical arcade business had been dominated by five Chicago based companies (Gottlieb, Williams, Bally/Midway and Chicago Coin) and they conducted business in a relatively stable environment with many incremental, but few radical innovations. With the disruption of Pong, the whole market structure changed. A number of new companies where started to develop Pong games and was soon followed by the older electromechanical game companies that tried to adapt their organizations to the new market. The arcade industry that was one region, one technology and 5 companies in 1970 became a tale of two major regions (Illinois, Chicago area and California, Silicon Valley area), two technologies and 27 companies in 1974 (table 1 and figure 3).

Table 1: First electronic arcade game manufacturers 1972-1974

Manufacturer	Year of entering the market for electronic arcade games	Country of origin
Computer Recreations	1971	California
Nutting Associates	1971	California, Mountain view
Atari	1972	California, Los Gatos
For-Play	1972	N/A
Allied Leisure	1973	Florida, Hialea
Amutronics (c/o PMC 1974)	1973	N/A
BAC Electronics	1973	New Jersey, Cherry Hill
Brunswick	1973	Illinois, Stokie
Chicago Coin/Chicago Dyn.	1973	Illinois, Chicago
Kee Games	1973	California, Santa Clara
Meadow games	1973	California, Sunnyvale
Midway MFG	1973	Illinois, Shiller Park
Mirco games	1973	Arizona, Phoenix
PMC	1973	Pennsylvania, Sothampton
RAMTEK	1973	California, Sunnyvale
See-Fun	1973	N/A
SEGA	1973	Japan
Taito	1973	Japan
US Billiards	1973	New York, Amityville
Williams (Seeburg)	1973	Illinois, Chicago
Bailey International Inc.	1974	N/A
Computer games	1974	Massachuset, Hingham
Digital Games Incorporated	1974	California, Corina
Electra games (division of universal research lab)	1974	Illinois, Elk Grove Village
Electromotion Inc.	1974	N/A
Exidy	1974	California, Palo Alto
HID/Visco Games	1974	N/A
JRW	1974	California, Sunnyvale
UBI	1974	New Jersey, Union
Volley Industries	1974	Canada, Montreal

Sources: International Arcade Museum, Arcade History Database, Ralph Baer etc.

Initially, all companies that entered the market made more or less similar imitations of the original Pong. Technologically, it was easy to make these imitations and Atari itself even increased the incentive for the creation of such market when its production capacities was far bellow that of the demand. Atari had the Pong market for itself in only a few weeks, and in 1973 17 imitators produced Pong games (table 1 and figure 3). When the traditional Pinball manufacturers Williams and Midway/Bally entered the market it became apparent that their superior manufacturing capabilities and developed distribution network was a major advantage in the homogenous market. At the end of 1973, they had each sold as many Pong games as Atari (around 10.000 each (Baer 2005, p. 95)). The limited manufacturing capabilities and distribution network among many of the new Pong imitator companies restrained most of them from selling more than a few hundred Pong games. Interestingly, intellectual property protection did little to hinder the large number of entrance (see Baer 2005 p. 130). A study of a majority of the arcade games sold in 1972-1975 period shows that the dominance of tennis type Pong games in percentage of units sold was 87% 1973, 38% 1974 and 21%1975 (derived from Baer 2005 p. 10-13).

The reliance on a single concept was the result of a lack of innovation capabilities among the firms in the market combined with technological restraints. Many firms had no other capabilities than

to imitate and manufacture games and at the same time technology put such restrains on what was achievable that it was hard to diversify into new game concepts that could compete with Pong. Atari and its fully owned company Kee Games was the first company to try to introduce new games in the arcade environment at the end of 1973, but initially they failed to compete with the success of Pong (Cohen 1984; Kent 2001).

When the homogenous product market prevailed, the consumers' appetite for new entertainment experiences could not be sustained. Already at the end of 1973 the first signs of harsher times in the industry emerged. In a contemporary memorandum from the November 1973 MOA (Music Operators of America) expo the "father of video games', Ralph Baer described the lack of differentiation in the market:

"Right about time of show, business takes nose dive – Why ? – General panic in industry – little guys starving – Midway Mfg only making about 50 units/week – ATARI "struggling', I'm told…– Best guess as to cause: Everybody copies each others game – basically ATARI's design – creative engineering practically non-existent – public suddenly fed-up with 28 x same damn thing! Moral: Nobody knows for sure; but best guess is GAMES WILL SELL BIG, IF they're different, challenging – must provide "hand-to-hand combat' between players, lots of action, noise, not readily "learnable' games.' Baer (2005 p. 96)

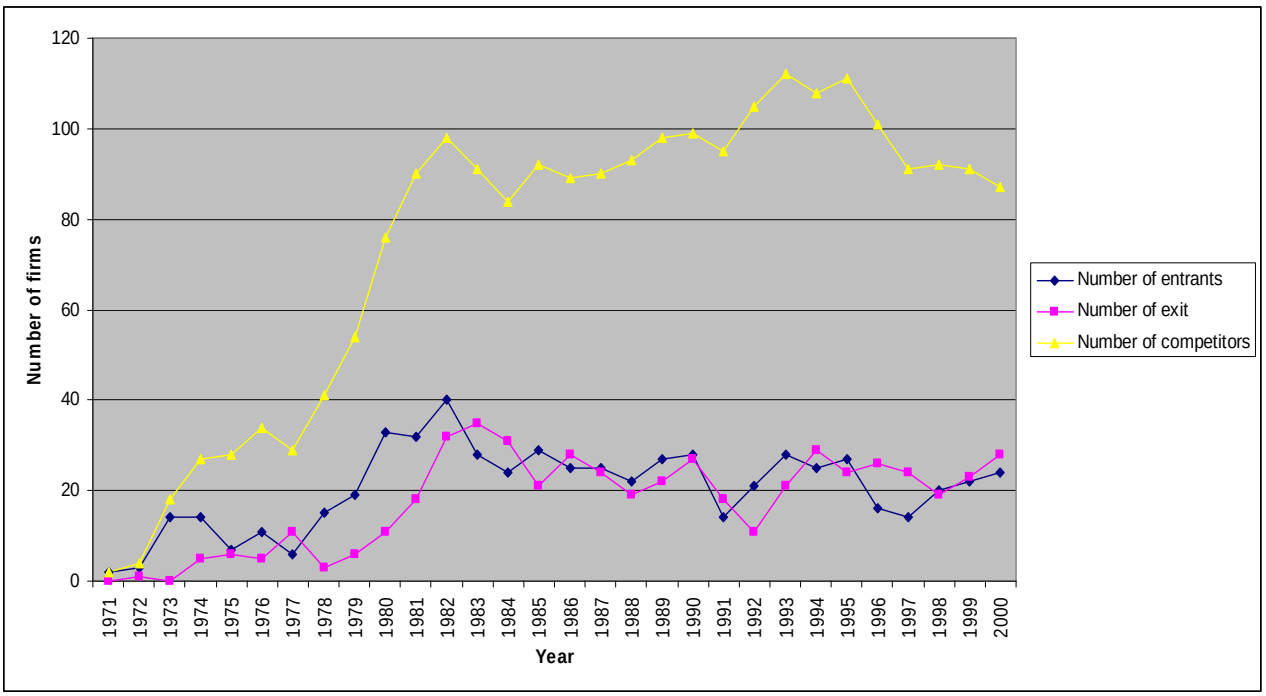
During the following years, a shakeout occurred in the arcade industry in which a large number of small manufacturers were forced out of the market. The number of firms entering the industry was declining during the 1974-1977 period, at the same time firm exits increased (figure 3).
When the capability to develop new innovative games became crucial in the competition, none of the smaller imitator companies that had entered the market survived in the business. Although statistics over the early arcade industry are unreliable, marketing data from the major industry magazine of the time indicate that the arcade industry decreased more than 50% between 1974 and 1975 in terms of units sold (Baer 2005, p. 10-13). As a result, in 1977 the number of competing firms actually decreased in the industry (figure 3). It was a strong case of the structural inertia of companies and their inability to adapt to changing market conditions

Of the 3D factors, low entry barriers and a lack of differentiation was present in the market. The liability of newness and smallness made many of the smaller companies vulnerable when market condition became harsher. Being small, generalist companies, they could not adapt for the changes from a homogenous to a diversified market that required innovative specialist companies. The exits that followed was not destructive, but increased the possibilities for the innovative companies that where left in the market to regain growth and profit margins. The absence of a disruptive technology meant that all elements where not there for a crash to occur, but enough for a major shake out of firms with an organizational form ill suited to adapt to the new capabilities that where required. In the new diversified market reliant on a larger number of game concepts, the capability to constantly innovate new games became a competitive advantage for firms.

The shakeout in the arcade industry was a necessary adjustment to the changing capabilities requirement in the industry. The exit of the imitators from the market did not only increase the pressure to innovate for Atari and Midway, but it also opened up a resource space that could support companies with innovation capability as their main competence in the market. The result was a new wave of firm entrance from 1978-1980 in which a larger number of firms with a combination of manufacturing and innovative capabilities entered the market (figure 3). At the same time, the number of firm exit in relation to firm entrance was considerably lower during the period. Most of the innovative firms in this new entrance wave were Japanese firms (Konami, Namco, Nichibutsu, Irem, Data East (DECO), SNK and Banpresto all entered the industry during 1978-1980). While many of those innovative Japanese companies would reap considerable success in years to come and produce a high number of arcade titles, most of new US companies that entered during this period was less competitive and where forced out of the market during the arcade 1982 shake-out. The constant diversification into new game concepts 1978-1981 by numerous Japanese companies together with Atari, Williams and Midway intensified the process of creative destruction

that facilitated the highest growth period in the history of the arcade industry, depicted as "the golden years of the arcade'.

Figure 3: Entrants, exit and number of competitors in electronic arcade games 1971-2000



Source: Author's analysis of Arcade History database, KLOV database, PlayMeter, Baer (2005).

The 1977 console crash

"…the appearance of General Instrument's AY-3-8500 game chip in March of 1975 changed everything – forever. Suddenly anybody would soon be able to produce a high quality Pong-like video game for home use.'
Ralph H. Baer, inventor of the video game console, (Baer 2005, p 92)

The early console industry had a similar dynamic of delimited differentiation and decreased entry barriers that characterized the early arcade industry, but the subsequent introduction of disruptive technologies in the form of programmable consoles and handheld games was a decisive difference that contributed to a full scale industry crash in 1977.

Magnavox Odyssey (1972) with a simple Pong type game as its major game was the first video game console. The technology that where used (a large number of analogue discreet components) restrained it in several ways: it contained no sound, no scoring, had blurry graphic and a costly, labour intensive manufacturing process. As a result, it never became a profitable business for Magnavox (see Baer 2005, p 91). Subsequently, the fast progress in digital technology made it possible for the whole Pong game concept to be incorporated into a single integrated circuit chip with the benefit of considerable lower manufacturing costs and increased game quality. In an effect of the market similar to the introduction of single chips in the personal calculator market (Braun and Macdonald 1982) sales skyrocketed when Atari entered the market and released the first single chip Pong in 1975. Just like Pong for arcades, Atari's manufacturing capacity was limited and the demand far surpassed supply by the Christmas of 1975. A large number of the available U.S. chip manufacturers of the time swiftly developed their own Pong chip that they introduced during 1976 and 1977 and sold on the open market for 5-10 USD. With the help of the chip, basic assembling capabilities were the only thing needed for firms that wanted to enter the lucrative market for Pong consoles. Throughout 1976 and 1977, established and newly started companies rushed into the market to manufacture Pong consoles.

As a result, the Pong console market went from a market of 7 companies introducing pong consoles in 1975 to 34 in 1976 and 82 in 1977 (table 2)[2]. The growth was almost entirely based on the introduction of the "Pong in a chip'. The number of systems introduced using Pong in a chip increased from 1 (Atari) in 1975 to 54 in 1976 and a record high 162 systems in 1977 (table 2).

Table 2: The rise and fall of the Pong console market

Year	Manufacturers releasing a Pong console	Pong models released	Systems introduced using Analogue technology or a large number of digital components	Systems introduced using dedicated Pong chips	System released in North America	System released in Europe
1972	1	4	4	0	4	0
1973	0	0	0	0	0	0
1974	3	5	5	0	2	3
1975	7	10	9	1	5	5
1976	34	62	8	54	50	12
1977	82	162	0	162	60	101
1978	29	36	0	36	8	27
1979	6	8	0	8	0	8
1980	0	0	0	0	0	0
1981	3	3	0	3	1	2
1982	4	4	0	4	0	4
1983	2	2	0	2	1	1

Source: Derived from Pong Story Rarity Database (Winter 2006).

Despite the success of dedicated consoles in 1976, the market crashed in 1977 when all 3D factors where present and together created the dedicated Pong console crash. In terms of differentiation, it was a highly homogenous market in which every company relied on the same Pong game concept and few product features separated the companies. In 1977 an increasing number of consumers had become tired of Pong consoles in the US. At the same time the programmable console (first introduced 1976) and handheld games (introduced 1977) where two disruptive technologies that both had their distinctive advantage over the dedicated Pong consoles. While handheld games offered the opportunities for cheap, simple games for a lower cost and ubiquitous playing possibilities, programmable consoles offered a diversity of new types of games. When these new disruptive technologies started to make their impact on the market in 1977, production and stocks among the manufacturers of dedicated pong consoles where record high. At the Christmas of 1977, supply far exceeded demand. The market crashed and during the course of a few months, the market for Pong consoles had disappeared (table 2). A cutthroat price war followed in which Pong manufacturers sold off their stocks far bellow manufacturing costs (Herman 2001; Cohen 1984). With a few exceptions (Atari, Coleco and Magnavox), almost all US manufacturers of dedicated consoles left the video game market in 1978 and never reappeared. The same pattern reiterated itself almost identically in the European market, with the exception that the market became saturated a few months later in some European countries. The large number of firm failure in the 1977 crash was closely connected to the decreasing entry barriers in the industry and the liability of smallness and newness among the firms. There was a mismatch between the capability endowments among the companies in the population of firms in the dedicated home console market and the innovative capabilities needed for long term growth in the console industry through further innovations. Most of the Pong manufacturers had only basic assembly capabilities while the semiconductor manufacturers that made "Pong in a chip' had neither the knowledge of the game market or the capabilities to develop new game concepts. In the

[2] These number only incorporate numbers of those Pong systems with identifiable manufacturers and introduction year, the actual number of manufacturers in 1976 and 1977 was probably higher. One source estimates the total Pong market to over 500 models from 300 manufacturers (see Winter 2006).

short term firma that could free-riding on the success of the Pong concept and increase the production had the competitive advantages, but for the long term growth, new innovative concept had to be invented to sustain the growth. Driven by the introduction of the programmable consoles, such a shift in the market from the imitators to the innovators advantages did occur, but most companies could not make the transition. In statements that were similar to those that later would be put forward at the 1983 crash, many contemporary analysts claimed that the 1977 crash was the end of a short video game fad, similar to the problem that other digital consumer industries experienced at that time (Braun and Macdonald 1982). Initially the price war had a negative impact on the market for programmable consoles as well and only two (Atari and Coleco) of the five companies that released programmable consoles in the 1976-1977 where able to stay in the business (table 3). Atari could remain in the video game market despite heavy losses due to the financial stability of Warner who had bought the company in 1976 and continued to believe in a future of the disruptive programmable VCS console that Atari had released in 1977.

TABLE 3: PROGRAMMABLE CONSOLE SYSTEMS RELEASED 1976-1982

Company	Name	Nationality	Year introduced	Number of games produced	Games developed until	Number of units sold (million)	Companies other divisions
Fairchild	Channel F	USA	1976	26	1979		Integrated circuits
Bally	Astrocade	USA	1976	50	1983		Amusement machines, gambling machines
Atari	VCS/2600	USA	1977	500	1992	30	arcade games, home computers
Coleco	Telstar Arcade	USA	1977	4	N/A		Plastic products, leather articles
RCA	Studio II	USA	1977	N/A	N/A		Radio, TV
Interton	VC 4000	Germany	1978	40	1982		Family business making hearing aids
Magnavox (US subsidiary of Philips)	G7000	USA/Holland	1978	50	1984	2	TV manufacturer
APF	M1000	USA	1978	12	1978		stereos, calculators
Mattel	Intellivision	USA	1980	125	1990	3	Toys
GCE/Milton Bradly	Vectrex	USA	1982	25	1985		MB:Toys
Coleco (CBS)	Colecovision	USA	1982	100	1985	4	Plastic products, leather articles
Entex	Adveture Vision	USA	1982	4	1982	0.05	
Emerson Radio corp.	Arcadia 2001	USA	1982	35	N/A		Radio, TV
Hanimex	HMG 2650	Asia	1982	30	1983		
Atari	5200	USA	1982	70	1986		arcade games, home computers

Source: Forster (2005), Herman (2001).

The combined effect of the different disruptive nature of the programmable console and the handheld game made the crash even more severe. While the cheap but simple handheld games provided considerable advantages of cost and ubiquitous gaming in the short run, programmable consoles provided considerable quality advantages through differentiated gaming opportunities in the long run.

Handheld games were made possible as a result of the opportunities created by the fast declining costs of integrated circuits and LED display technology. By showing that electronic games was possible on other screens than television and by enabling cheap game playing opportunities anytime, anywhere; handhelds created new markets for digital games and showed the adaptability of the game medium to new technologies originally developed for other purposes[3]. Toy companies from the US (Mattel, MB) and later Japan (Nintendo, Bandai, Tomy) dominated the market (Gielens 2000).

[3] The first handheld games where greatly influenced by the handheld calculator technology. Both the LED display and the chip used in Mattels first handheld games had those influences.

Although handheld games where able to capture new market segments, the inseparability of hardware and software stifled innovation in software and created a rather homogenous product market and that did not change until Nintendo Game boy was released in 1989. Instead, new possibilities for creative destruction in hardware and software where possible with the development of programmable consoles which brought video games back on a path of growth that lasted five years.

Although programmable consoles where released in 1976-1977, it took a few years to reveal their true innovative opportunities until the large number of diversified innovative software had emerged and created a positive upward spiral, most visible for Atari VCS/2600 (table 3). It was the programmable consoles separation of hardware and software into two separate modules (console and cartridges) that spurred the creation of the differentiated software market and provided a way out of the destructive 3D factors behind the Pong console crash.

The new business model of the programmable console have often been compared to that of Gillette razor blades in which the razors themselves (the console hardware) provides the less profitable (or even loss generating) but more long lived part of the business while the razor blades (the software) provides the profitable, but more short lived pert of the business. One of the results of the business model was that it involved considerable network externalities in the hardware and sales tends to increasingly be concentrated to one or a few console systems on the market. R&D costs, marketing efforts and software capabilities needed where some of the entrance barriers in the programmable console hardware market of the late 1970s that separated it from dedicated consoles. As a result, in 1976-1982 only 15 programmable systems where released, a major difference compared with the many hundred dedicated console systems (table 2 and 3). Of those 15, Atari's unit sales were more than seven times that of its closest competitor Mattel.

Detached from the hardware, the successful operation of a software development project was not dependent on the performance of the hardware development. The modular system of the programmable console enjoyed all the potential benefits that research have connected to modular systems (Garud 2003) such as increasing speed, scoop and reach of innovations, the continuous reuse of system parts and a higher degree of stability (see table 4). The programmable console could also reap the benefit of the prolonged learning process involved in game development. As the hardware got more complex, learning what the hardware was capable of in terms of games increasingly became a discovery process for game developers that where unfolding through time. Many new innovative game concepts where discovered several years after the first programmable consoles where introduced. Nonetheless, the variety and innovative games that where possible on these first, technologically very constrained systems, was remarkable and an important source of growth for the industry. Such a differentiation in games had not been possible if it wasn't for the malleability of software in relation to hardware, accurately described by the legendary game developer John Carmack:

> "Software is so wonderful in a unique way. The people who set up for a physics experiment spend a year of preparation time, tooling around doing things. And then you spend another year analyzing it. With software you can have an epiphany and just sit down and hash it out. You can make it happen right there. It's the most malleable media to be working in for any kind of intellectual pursuit."
>
> John Carmack (Colayco, 2000)

TABLE 4: Different systems of innovation: dedicated consoles, programmable consoles, home computers

	Dedicated consoles (1972-1978)	Programmable console (1976-)	Home computer (1977-
Degree of modularity	One module consisting of both hardware and software. Initially many discreet components but 1975 Atari introduced the first "pong in a chip'.	Two freestanding, compatible modules: console hardware and software (cartridges)	Two freestanding, compatible modules: console hardware an software (magnetic cassettes and disks).
Business model	Profits from the sales of the console. Market concentrated	Razor and Blade "Gillette model', low or no profit	Profits both on the sales of hardware and software, but no

	to Christmas sales.	margins on the hardware (console), high on the software (cartridges). Market increasingly around the year.	Gillette model. Around the year market.
Market characteristics	No network externalities. Homogenous market characterized by price competition. Decreasing entry barriers spurred firm entries.	Considerable network externalities. Positive feedback loops between hardware and software Favoured the creation of one dominant hardware company (Atari). Subsequently (1979-) many software companies entered the market.	Network externalities in hardware. A large number of i firms initially, but only a few was left after a few years. Homogenous hardware market, but heterogeneous and diversified software market.
Reuse of system parts	No reuse of system parts	Reuse of the hardware (console) for several games. No possibilities to reuse the software (cartridges)	Reuse of hardware for several games and other programs. Possibilities to reuse software medium (disks and tapes) as well.
Stability and risks	Reliance on single concept increases the risk. Innovation in new software is risky: if a new game concept fails the total production of thee game console suffers.	Lower risk of innovation. If a new game concept fails, it is only the cartridges that fail. Diversity in software decreased the risks involved in reliance of a single game concept.	Production risk of game disks and game tapes lower than for game cartridges (they don't have to be produced in batches, but on demand). The large number of incompatible systems initially involved the risk of supporting the wrong system.
Innovations (speed, scoop reach)	Imitation of successful game concepts. Reliance on single game concepts makes a less risk taking market where it is more difficult for differentiated tastes and niche concepts. Single game concepts limit the adaptability towards different tastes.	Enhanced speed, scope and reach of innovations. Innovations occurring continuously in software. Game software development becomes a profession. Heterogeneous software market reach more differentiated tastes.	High speed and scoop, moderate reach of innovations User created software makes possible huge variety of tastes close to actual demand. Heterogeneous software market, but the home computer had less market reach because due to its high price and relatively complicate use.
Development Process	Only a few companies did any software development, successful concept was imitated by chip manufacturers and sold to a large number of assemblers.	Initially software development in house by the hardware manufacturers. Subsequently (1979-) a large number of independent software developers joined the market. Programming knowledge difficult to acquire.	Software development by user possible and common, a number of hackers started thei own game software development companies.
Entrance Barriers	Low entry barriers in 1976 when the core component (Pong in a chip) containing th game became available on the open market. No need for any substantial capabilities in either hardware or software for manufacturing.	Initially high entry barrier due to more complicated development process and the need to initially have capabilities in both software and hardware development. At the end of the console cycle, entry barriers decrease in both hardware and software.	Initially low in software. A skilled user could develop and distribute self made games since the home computer was programmable. Later on, marketing capabilities and financial strength became mor important. Higher and increasing entry barriers in hardware.
Differentiation	Homogenous market. The only differentiation appear in	High differentiation in software, less in hardware	Very high differentiation in software. Initially the market

	marketing and appearance design of the products.		consisted of both console games and new adventure games.

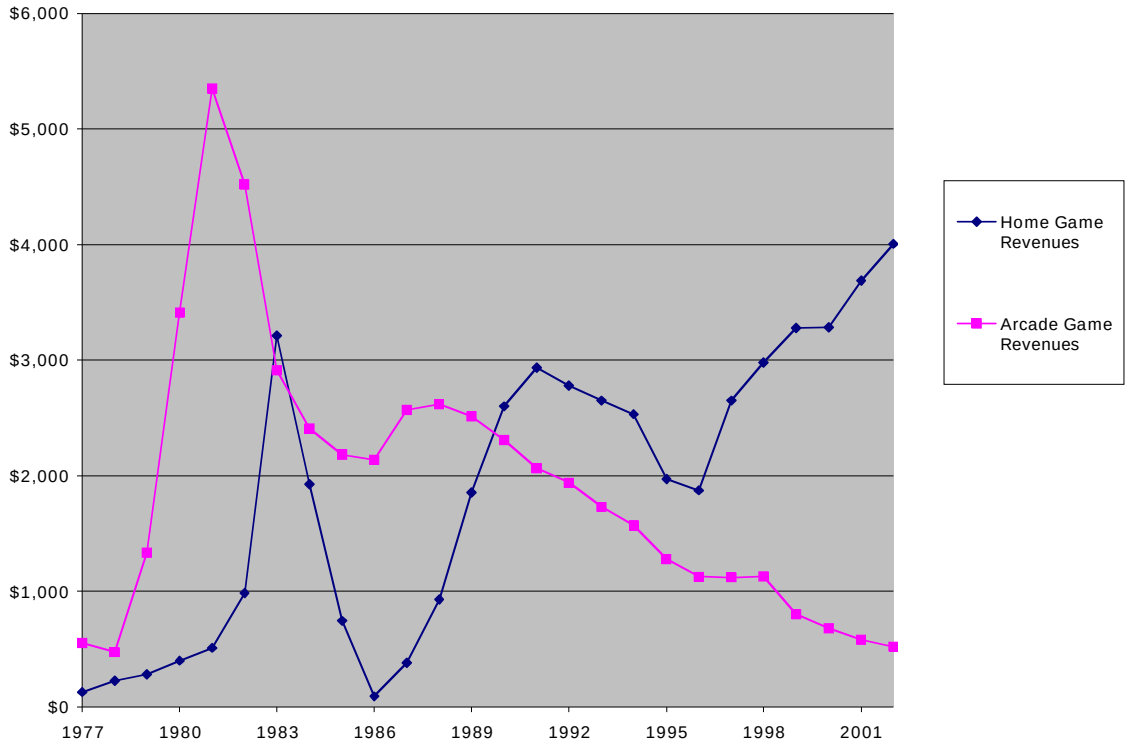
The Video Game Crash of 1983

"This most visible aspect of the computer revolution, the video game, is its least significant. But even if the buzz and clang of the arcades is largely a teen-age fad, doomed to go the way of Rubik's Cube and the Hula Hoop, it is nonetheless a remarkable phenomenon.'
Otto Friedrich, TIME, January 3, 1983

The year 1983 have been synonymous with the video game crash among video game historians, viewed as an exceptional event requiring equally exceptional explanations. That is not needed. The same 3D dynamics of disruptive technologies, delimited differentiation possibilities, decreased entry barriers and destructive liabilities of newness and smallness of the industry that characterised the 1977 crash was also the main driver behind the 1983 crash in video game consoles. The US arcade market also decreased around the same time that the programmable console market crashed, but the decease of the arcade market was more prolonged, less deep and not as rapid. It is therefore better depicted as a shake out than a crash (figure 2).

In the course of the two last months of 1982, the general perception of video games in the US changed from being the future of entertainment to a teenage fad (Marbach 1982; Friedrich, 1983)

Figure 2. US home game vs. arcade sales (millions of dollars, inflation adjusted to 1983 year's value)



Source: Williams, D (2005). *Note*: the exact accuracy of some of these individual numbers could be questioned, especially for the home game market in the US. However, the general trend is not.

The fall of the arcade market

Of the 3D factors, declining entrance barriers, delimited differentiation and destructive liabilities of newness and smallness characterized the arcade industry in the beginning of the 80s.

By 1980, the arcade market had grown bigger than the pinball industry. It was a process of creative destruction where the old electromechanical Pinball market in the arcade halls was destroyed and new markets for arcade video games where constantly created. As arcade games promised high returns an easy service, they soon became attractive for far more venues than the original pinball venues (penny-halls and bars) and invaded restaurants, liquor shops, gas stations, shopping malls, motels, convenience stores and various other locations.

The declining entrance barriers did not only attract new venue owners, but ordinary people as well. A number of firms emerged in the beginning of the 80s that offered small scale investment opportunities to individuals to buy or lease a few arcade games on various locations. However, the market was plagued by a number of frauds and when it was legal, it was often less attractive locations and arcade games that where offered (Changing Times 1982). Among operators, the risks of liability of newness increased. In 1982 signs of over saturations started to appear in the arcade market as an increasing number of operators reported decreased profits or losses. In most parts of the US, arcade games had expanded into virtually all desirable public places and a further differentiation into new public places could only be done on less competitive venues. The number of video games arcade doubled between 1980 and 1982, but the average revenues of coin operated games decreased from 140-150 USD/week in 1981 to 109 USD/week in 1982 (Thomas 2005).

It was not only differentiation opportunities in operation that stagnated in 1982, differentiation among the essential foundation for the arcade business, the arcade machines and the entertainment experience they offered, did stagnate as well. The 1978-1981 "golden age' period in arcade games had been a period of increased differentiation characterized by continuous new innovative arcade games. Some of the most successful and innovative arcade games from Japanese and US companies emerged in the 1980 and 1981: Space Invaders (Atari, 1980), Pac Man (Namco, 1980), Defender (Williams, 1980) Donkey Kong (Nintendo 1981) and Ms. Pac Man (Namco/Midway 1981). By 1982 the degree of new innovative games had already started to decline and growth in the arcade market was "stymied by an unexpected halt' (Business Week 1982). Operators hoped that new technologies in the form of Laser disc arcade games should revitalise the market in 1983, but due to several reasons (most notably lack of interactivity, maintenance problems, expensiveness) they where a technological dead end and consumer lost interest in the new technology within a year.

During the 1982-1984 period revenues in the US part of the industry almost halved (figure 2) and the total number of arcade manufacturing firms decreased worldwide (figure 3). Unlike the more vigorous Japanese arcade market, the arcade industry in the US had some short periods of upswings later on but never really regained growth again (figure 2). For US manufacturers and distributors, the large amount of unsold equipment in 1983 and 1984 proved fatal. Operators where squeezed out of the market by both declining number of visitors and the prize war that followed when a number of operators offered game play for greatly reduced prices. Japanese arcade companies with a healthy domestic market, high degree of operational efficiency and a larger amount of innovative games survived and increased their market share in the US. Today, there are no US company manufacturing arcade games on a large scale anymore.

The biggest US arcade companies at the time of the crash was Atari (mainly manufacturing) and Bally/Midway (operation and manufacturing). Their development during the shakeout shows how difficult it was even for the largest US companies to survive in the arcade shake-out. Due to the financial difficulties, Warner sold the arcade division of the company to Namco (Japan) in 1984. Contrary to Atari, Bally tried to stay in the business throughout the arcade shake out, but the price was high. Staggering losses in the amusement game division of the company in 1983 and 1984 forced it to implement a 122 million USD restructuring plan in 1984 through which the division after considerable downsizing and inventory write off became profitable again in 1986 (table 5). But restructuring plan could only stop the financial losses and not create opportunities for growth. The revenues of Bally's

amusement game division continued to decrease rapidly during the whole 1983-1988 period until the company sold the division in 1988 to WMS Industries.

Table 5: Bally Amusement games and services division

	1983	**1984**	**1985**	**1986**	**1987**	**1988**
Revenues (million USD)	327.5	264.2	177.0	127.7	121.1	109.3
Operating income/loss before restructuring provision (million USD	-56.5'	-92.0'	-1.2'	19.7	23.4	20.5
Provisions for restructuring amusement game business (million USD)	0	-121.7'	0	0	0	0
Operating margin, percentage (excl. Restructuring provision)	-17.2	-34.8'	-0.6'	15.4	19.3	18.8

Source: Bally Annual reports

The fall of the programmable console market

The event surrounding the 1983 programmable console crash had all 3D factors: disruptive technologies in the form of home computer games, delimited differentiation as more and more similar games where made for the ageing Atari VCS game machine, decreased entry barriers and devastating liabilities of newness and smallness.

The 1979-1981 period in programmable consoles was a very innovative one with an increasing number of differentiated games of high quality appearing each year. Until 1979, Atari was the only company making games for its VCS console. There was a severe shortage of skilled game designers in the industry and by 1979 and Atari had only 12 game developers at that time according to one of its game designers (Dolan 2001). When four of these left Atari in 1979 they created Activision, the first independent video game company that only developed game software for other companies' consoles. Atari threatened with litigation, but the parties settled on a (still existing) business model in which independent game developers had to pay a certain royalty of their game sales to the platform manufacturer.

One result of the litigation was a rapid increase of new independent game developers in 1981 and 1982. According to the most complete database, 158 companies released games for the Atari VCS (AtariAge 2006). Most of these companies did only release a few games before the market crashed. The rapid firm entry in the US was fuelled by a vast amount of venture capitalist funding which saw all the elements of a lucrative market in video game development: potentially high growth, relatively low entry barriers and a possibility for quick, high rewards (Riley 1982). There were risks with the liability of newness and smallness among the many new video game developers. Due to the lack of talented game programmers most of them did not have the capabilities to compete on the same mass market game genres with Atari. Their financial situation was also very fragile. Venture capital financed companies without a long term commitment to the industry. When the market shifted, most of the small independent video game companies where forced to defunct and sold off their remaining stocks of game software for far bellow original prices (see e.g. Herman 2001; Kent 2001; Cohen, 1984).

In the increasingly crowded and competitive market, diversification was necessary to avoid commoditization but real as well as putative differences were increasingly difficult and costly to achieve. A number of companies tried to differentiate their product by relying on famous licenses from movies, music and other entertainment industries. Other companies unsuccessfully tried to exploit new niches such as adult games. When manufacturers of other programmable consoles started to release games for Atari VCS as well because of its dominating market position (Table 2), the market for Atari VCS games became even more saturated. The majority of the new video game software firms released games of substandard quality, but even dominating Atari lost much of it previous innovativeness (Cohen, 1984). The increased competition and the demand for video game companies to differentiate their products increased licensing costs in the video games industry dramatically. The peak of this development was when Atari licensed a game based on E.T. the movie in 1982 for around $20 million dollar a game that became the single largest commercial failure of a game in Atari's history (Cohen, 1984; Herman 2001; Kent 2001). Entry barriers also decreased in hardware and it became

possible for Coleco to release the Colecovision console in 1982 that could play Atari VCS as well (Herman 2001, p. 64).

As a result of the crash, average prices decreased for both video game hardware and software in 1983. (table 6) and the market for video games continued to decrease until 1986, when the market is claimed to have reached a record low 100 million USD (according to Nintendo of America (figure 2)). Decreased entry barriers, diminished opportunities for differentiation and liabilities of newness and smallness might not have created a full blown crash if it had not been accompanied by disruptive technology in the form of the home computer. When programmable consoles failed to innovate, the home computer where able to continue the process of creative destruction. Initially, the introduction of the home computer in 1977 had no large influence on the video game market, but as Moore's law continued and the market grew it increasingly did. In many ways, the home computer represented a completely different business model (table 4). One important difference was that it was possible for single talented users to program their own games. As a result, the number of game titles released for home computer systems initially far exceeded the number of games released for video game consoles (Forster 2005). The production on magnetic tapes or disks could be made on demand and did not require the large stocks of expensive cartridges. Many believed that the general purpose home computer would completely take over the market for consoles and the market trend in the beginning of the 80s seemed to support this view. While cartridges and hardware sales for consoles declined between 1982 and 1983, sales of entertainment software for home computers more than doubled during the same period (table 4).

Despite the innovative lock in, consoles had a future as a playing machine. In 1985 Nintendo introducing their NES/Famicom console in the US which could do nothing but play games. Nintendo had a strategy of far reaching quality testing and put all the effort on a few, well developed titles (Sheff 1993). Compared to the Atari VCS it could play new innovative games in the form of long adventure like Super Mario, Final Fantasy and Zelda.. NES became the most successful console system until that date with sales of almost 63 million unit's world wide, twice as many as Atari VCS (CESA 2005). It is noticeable that in Japan, a crash never occurred in the market in 1983. Comaparatively to the US market, the 3D factors was not present to the same degree. The population of firms where larger and more stable, differentiation was sustained by the successful introduction of Famicom in 1983 and the home computer never had the same disruptive effect.

Table 6: Retail sales of video game consoles and home computers

		1981	**1982**	**1983**
Video game consoles	Units	4,620,000	7,950,000	5,700,000
	Value, USD	577,000,000	1,320,000,000	540,000,000
	Value/units USD	125	166	95
Video game cartridges	Units	34,500,000	60,000,000	75,000,000
	Value, USD	800,000,000	1,500,000,000	1,350,000,000
	Value/units USD	23	25	18
Home computers	Units	360,000	2,261,000	5,027,000
	Value, USD	393,000,000	1,400,000,000	1,900,000,000
	Value/unit	1092	619	378
Entertainment software	Value	18,000,000	157,000,000	405,000,000

Source: Derived from Campbell-Kelly (2003) p 276

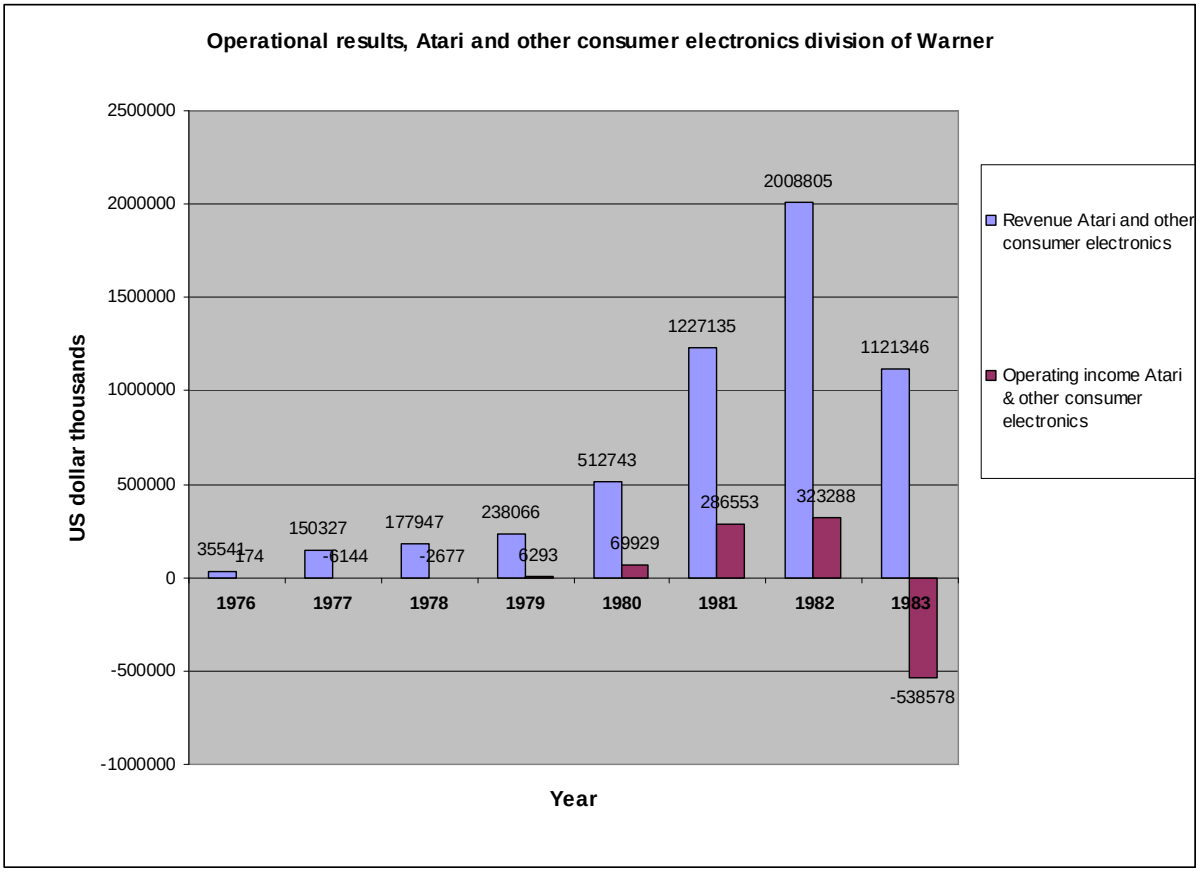
Atari's fall

As the leading video game company of the 70s, Atari experienced such a high growth (figure 4) that it was appointed the fastest growing company thus far in the US history in 1980 (Herman 2001). In the crash 3 years later, Atari made several attempts to restructure their business, adapt new strategies and change ownership, but none of these attempts where able to get the company back to a growth path again.. As the dominating company in the industry, Atari had the influence not only to react to changes in the industry, but also to use it dominant position to try to change the industry structure to

its favour. In the beginning of the 80s Atari started to act like a monopoly company and became mismanaged both internally in the firm and externally in its relations with clients. *Internally,* there were conflicts between management and the creative personnel of the company. As a result, many key game developers left the company and started their own business when that opportunity became possible. To retain its talented personnel, escalating bonuses where paid to those that stayed which where a substantial burden when the market decreased. *Externally*, Atari had started to mismanage its distribution in a way that made it harder to match supply with actual demand. One result of this was that retailer had to sell stocks of lower quality games to receive new ones (Dolan 2001; Cohen 1985), but more important was Atari's decision in 1981 to force retailers to order the entire stocks of games in for 1982 in advance (Cohen 1985; Kent 2001). Having experienced shortages in the previous years, retailers made huge orders for the following year. When the demand did not met the supply at the end of 1982, distributors where faced with huge inventories of unsold cartridges.

When the price war on games software started in 1983, Atari initially tried not to follow suit. However, the >500 million USD loss of the Atari division of Warner in 1983 (figure 4) put the whole Warner Communications into financial difficulties and forced it to sell Atari's home video game and home computer division to Jack Tramiel in 1984. Before the transition, Warner dumped huge stocks of unsold software on the market which worsened the crash (Avtivision 1985, p. 1). Due to several reasons (Kent 2001, p. 230), Atari also failed with the introduction of its predecessor to the Atari VCS in 1982, Atari 5200 (table 3). Although the Atari under Jack Tramiels ownership first tried to concentrate their effort on the home computer market and later recapture the video console market, both these endeavour failed and today only the name and the physical assets of the former company remains.

Figure 4



Source: Warner annual reports

Concluding remarks

The history of the video game industry could be described as two periods, an unstable one (1970-1986) in which industry wide crashes occurred in an immature industry and a more stable one (1987 onward) in which a more mature industry in which industry wide crashes was absent.

Industrial crashes through that forces a whole population of firms to exit an industry within a short period of time is a rare phenomenon in most industries. In the video game industry, this was the characteristic recurrent feature of the first period (1972-1985) of the industry. This paper has argued that all of the four crashes and shake-outs that characterised this turbulent era shared a similar structural dynamic and could be explained through the combined effect of 3D factors: disruptive technologies, delimited differentiation, decreased entry barriers and destructive liabilities of newness and smallness. When all these factors present, they reinforced each other in a vicious downward spiral and a crash occurred. The decisive impact of those 3D factors on the video game industry could be explained by the permeating influence of the process of creative destruction. Driven by rapid pace of new technological innovations in the industry, constantly new, differentiated playing experience was necessary for growth in the industry. It was by constantly creating special markets on their own through real as well as putative differences that firms could avoid commoditization. In the early video game industry, opportunities for differentiation were limited and innovative lock-in common. However, whenever one game platform stagnated, another one often emerged and continued the process of creative destruction. There where constant discrepancy between the capabilities that the majority of the firms had, and the capabilities needed for further growth. When an industry crash occurred, firms had little opportunities to change their capabilities and failure was inevitable for most firms in the industry. In many regards, the crashes were a necessary for the industry to come back to a pattern of growth again.

References

AtariAge (2006). "Atari 2600 Companies'. *Atari Age database*. Accessed January 2006: <http://www.atariage.com/company_list.html?SystemID=2600>

Activision (1985), "Activision Annual Report 1985'.

Anderson, P. and Tushman, M. (1990), 'Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Change', *Administrative Science Quarterly*, 35(4), 604-633

Bally. 'Bally Annual Report' 1983-1988. Bally

Baer, R. (2005), *Videogames in the beginning,* Springfield US: Rolenta Press.

Becker, D. (2005). 'The Return of King Pong', *CNet News.com*, 15 March 2005, <http://news.com.com/The+return+of+King+Pong/2008-1043_3-5616047.html>

Braun, E. and Macdonald, S. (1982), *Revolution in Miniature*, 2nd revised edition, Cambridge: Cambridge University Press.

Business Week (1982), 'Arcade video games start to flicker' *Business Week,* 12 (6), 39-40.

Campbell-Kelly, M. (2003), From Airline Reswrvations to Sonic the Hedgehog, Cambridge, Massachusetts, MIT Press.

Carroll, G. and Hannan, M. (1995), *Organizations In Industry*, New York and Oxford, Oxford University Press.

CESA (2005). *2005 CESA White Paper,* Japan: Tokyo, CESA.

Changing Times (1982), 'The video game business- it's easy to lose', *Changing Times,* (9), 34-36.

Christensen, C. (2003), *The innovator's dilemma : the revolutionary book that will change the way you do business*, New York: HarperBusiness Essentials.

Cohen, S. (1984), *Zap, The Rise and Fall of Atari*, Xlibris Corporation.

Colayco, B (2000),'John Carmack Interview', *Firing Squad*, 9 February 2000, available at http://firingsquad.com/features/carmack/default.asp

Dolan, M (2001), "Behind the Screens', Wired Magazine (9)5. Available at: http://www.wired.com/wired/archive/9.05/history_pr.html

Dosi, G. et.al. (2000), *The Nature and Dynamics of Organizational Capabilities*, Oxford: Oxford University Press.

Forster, W (2005), *The Encyclopedia of Game Machines*, Germany: Game Plan.

Friedrich, O. (1983) 'The Computer Moves In' *TIME Magazine,* 3 Jan 1983, available at: <http://www.time.com/time/archive/preview/0,10987,953632,00.html>

Garud, R. et.al (2003), *Managing in the Modular Age: Architechture, Networks and Organizations*, Oxford: Blackwell Publishing.

Gielens, J. (2000) *Electronic Plastic*, Germany, Berlin: Die Gestalten Verlag.

Gratzer, K. and Sjögren, H. (1999), *Konkursinstitutets betydelse i svensk ekonomi*:, Stockholm: Gidlunds Förlag and Riksbankens Jubileumsfond.

Hannan, M. and Carroll, G. (1992), *Dynamics of Organizational Populations*, New York and Oxford, Oxford University Press.

Herman, L. (2001), *Phoenix: the fall and rise of videogames.* Springfield NJ,US: Rolenta Press.

iSuppli (2005) 'The iSuppli Xbox 360 Teardown Highlights IBM's Dominance in Next-Generation Consoles' iSuppli press release Nov 22, 2005 < http://www.isuppli.com/news/xbox/>

Jones, S. W. (2004) 'Exponential Trends in the Integrated Circuit Industry', *ICKnowledge*, 29 March 2004 http://www.icknowledge.com/trends/Exponential2.pdf

Jörnmark, J and Ernkvist, M (2004) 'Game over Boundaries, the Coevolution of Videogames, Media and IT' Paper presented at the 2004 SHOT Coference, Amsterdam, <http://www.histech.nl/shot2004/programma/txt/jornmark.asp?file=jornmark>

Jörnmark, J. et al. (2005), 'Wherever Hardware, There'll be Games'. Conference Proceedings, DIGRA Worlds In Play, Vancouver, <http://ir.lib.sfu.ca/handle/1892/1600>

Kehoe, L. (1982).,'The great "boom or bust" gamble- Video Games: A market on a knife edge', *Financial Times,* 28 September, 1982.

Kehoe, L. (1983). Atari seeks way out of video game woes. *Financial Times* 23, 14 Dec.

Kent, S. (2001), *The ultimate history of video games : from Pong to Pokemon and beyond,* New York, Three Rivers Press

Lindgren H. (1999) 'Comments to Karl Gratzer, Konkursens orsaker', in: K. Gratzer and H. Sjögren, *Konkursinstitutets betydelse i svensk ekonomi:*, Stockholm: Gidlunds Förlag and Riksbankens Jubileumsfond, pp. 160-162

Moore, G. (1965)'Cramming More Components Onto Integrated Circuits', *Electronics* 38(8).

Riley, B. (1982), 'Video Games: An explosive billion-dollar boom', *Financial Times*, August 7, 1982

Schumpeter, J. A. (1939), *Business Cycles vol. 1*, New York and London: McGraw-Hill

Schumpeter, J. (1943), *Capitalism, Socialism and Democracy*, London: George Allen & Unwin Ltd.

Sheff, D. (1993). *Game Over - How Nintendo Zapped an American Industry, Captured Your Dollars, and Enslaved Your Children*. New York, Random House.

Thomas, D (2005) 'ICWhen, PC and Video Game history, 1982', *ICWhen,* 24 July 2005, available at < http://www.icwhen.com/book/the_1980s/1982.shtml>

Warner. 'Warner Annual report' 1977-1985

Williams, D. (2004), *Trouble in River City: The Social Life of Video Games*, Dissertation, department of Communication Studies, University of Michigan, Michigan.<https://netfiles.uiuc.edu/dcwill/www/research.html>

Winter, D (2006), Pong-Stpry rarity guide database, accessed Jan 2006 < http://www.pong-story.com/mypongs.htm>

Vogel, H. (2004), Entertainment Industry Economics: Sixth Edition, Cambridge: Cambridge University Press.