PAC-MAN FOR THE VIC-20

Game Clones and Program Listings in the Emerging Finnish Home Computer Market

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INTRODUCTION

Games can become notable and recognized in many diverse ways. It is possible that a game is already appreciated among its contemporaries, for example, if it is considered to be of exceptional quality, represents a turning point from a genre perspective, gains significant success in the market, or receives some sort of cult status among subcultural circles. It is equally possible that a game acquires its noteworthy status only afterwards, thanks to amateur or professional historians who discover its importance for one reason or another. Contemporary recognition is often amplified afterward through the work of historians and in various historical presentations (Suominen, 2016; Suominen & Sivula, 2016).

In this paper, we analyze a game that is not interesting due to its high quality, exceptionality, or contemporary recognition – quite the contrary. We analyze a *Pac-Man* clone created by Finnish gamer programmer Stavros Fasoulas (b.1968) for the VIC-20 computer (see Figure 1). In the larger picture, the game exhibits very typical characteristics of the computer hobbyist and game cultures of its time's and does not exactly stand out from the

rest of its contemporaries. The game is relevant and important exactly because of its typicality, and its connections to wider contemporary phenomena. However, it also has certain special features – its programmer, publication forum, and name – that explain why we have selected it as a case example.
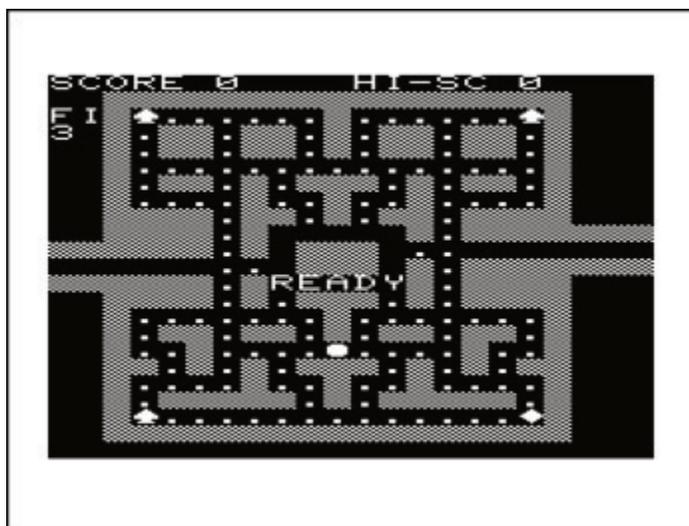
Figure 1. Pac-Man for the VIC-20 running on the VICE emulator.

In the published program listing of the game, there is a mention that the game was programmed in September 1982, but the code was actually only published in May 1984. In 1986, Fasoulas gained international recognition with his *Sanxion* game, published by the British company Thalamus for the Commodore 64, and he was the first Finnish game programmer to have an international hit. Therefore, Fasoulas and his games – although usually not the *Pac-Man* clone – have been referenced in a number of popular and academic game history books and articles since then (e.g. Reunanen, Heinonen & Pärssinen, 2013; Kuorikoski, 2014, 27). The *Pac-Man* clone is most likely Fasoulas' first released game and its publication context is also special.

The code appeared in the first issue of the home computer

hobbyist magazine *MikroBitti*, which rapidly became one of the key players in early Finnish computer hobbyist and game cultures. *MikroBitti's* circulation was already 44,780 copies in 1985 and stayed at close to 40,000 copies throughout the 1980s (Finland's population was then about 5 million); it was the most popular Finnish computer magazine of the time. The importance of the publication can be understood by comparing the figures to, for example, the UK (population 56.5 million at that time), where the most popular computer game magazine was *Computer and Video Games,* selling around 80–100,000 copies each month at the height of its popularity in the middle of the decade (Kirkpatrick, 2016, 6; Kirkpatrick, 2012). *MikroBitti* and its spin-off publications also followed Fasoulas' successful career, building both his and his games' national pioneer status (*MikroBitti* 12/1986, 5; *C-lehti* 3/1987, 5).

The third trait of the particular *Pac-Man* variant is that it was called "Pac-Man for the VIC-20," which differed from the typical naming of game clones. Most often, they had names that bore a major resemblance to the original titles but that were still different, or could be recognized as clones while reading the descriptions of the games (mazes, gathering treasures, main character chased by enemies, etc.). This direct connection to one of the best-known video game icons in the world makes the game a bit of a curiosity among its contemporaries. Plenty of discussion on *Pac-Man*'s influence on game design exists (see Newman, 2016, 4) in contrast to the research on *Pac-Man*'s influence on programming, which is our key issue here.

In this article, we study how one can explain Fasoulas' *Pac-Man* clone in the context of the Finnish computer hobbyist and game cultures of the early 1980s. Why was it programmed and published as it was? Which larger cultural and technical factors was it affected by? In addition to the contextualization and analysis on the role of computer and game journalism in the formation of cultural phenomena, we also conduct a close

reading of the game's program code. The source material of the study consists of the source code, interviews, archival material, and widely circulated computer magazines and smaller club magazines in particular (on club magazines, see Nylund, 2016). Unfortunately, we have not been able to interview Fasoulas himself, as he has retired from the computer industry and, as far as is known, lives abroad. Some of his personal views can be found, however, in interviews that were published in the 1980s (*MikroBitti* 12/1986, 5; *C-lehti* 3/1987, 5; *Zzap! 64* October 1986, 83).

Theoretically, the article is connected to the rising research interest in local game histories as well as to the emerging software and platform studies paradigms (Fuller, 2008; Bogost & Montfort, 2009; Montfort & Bogost, 2009, 147–150). Melanie Swalwell (2009, 266) has emphasized the study of local game and software cultures, not only because they provide a more diverse perspective on the digitalization of culture "beyond a US and Japan centric" view, but also because of the substantial importance that local "author involvement" had in writing or typing game code for early home computers (see also Swalwell 2008). We follow the Montfort et al. (2013) style of deep analyzing and close reading of code in such a way that "computer code is approached as a cultural text reflecting the history and social context of its creation." (p. 3). Our paper also offers an example of how to study those games that initially appear uninteresting and mundane – almost anti-monumental – compared to highly regarded and known classics (on game historical monumentalization, see Suominen & Sivula, 2016). Swalwell (2008, 193) has indeed noted that "home coding" may have been overlooked in research because of its everydayness.

The rest of the article consists of four sections. First, we describe *Pac-Man's* little-known arrival and diffusion in Finland. Next, we deal with the questions of program listing publishing and the creation of a public sphere within magazines (Kirkpatrick,

2012; 2016). The last section before the conclusion focuses on the source code and characteristics of *Pac-Man for the VIC-20* at a low level, along the lines of the platform studies approach (see Montfort & Bogost, 2009, 147–150).

HOW PAC-MAN CAME TO FINLAND

Pac-Man has been a central icon of international game culture since the early 1980s. Its importance has gone far beyond the game itself. James Newman (2016, 4) notes that "Pac-Man's most important contribution, however, is found not in its influence on other games but rather in the way it affected popular perceptions of video gaming within popular culture."

There is no exact evidence on how and when *Pac-Man* came to Finland. Most likely, arcade versions of *Pac-Man* were installed in Finland in 1981–1982, as the game was introduced in Japan in May 1980 and in North America in October 1980, where it became a great success. Even though Finland followed international trends in video gaming, the situation with arcade games was special due to the fact that the 1976 Finnish *Law on Leisure Automata* gave a monopoly of video game automata, pinball machines, and billiard machines to the Finnish Slot Machines Association (Raha-automaattiyhdistys, RAY). The association had 2,500 automata (the figure includes video games, pinball machines, and some games targeted at children) in 1981, and its competitors owned about 1,800 devices, which they had to either sell to RAY or close operations by the end of the year (Suominen 2016; Numbers taken from RAY annual reports published in the *Potti* magazine.)

In 1982, RAY began to produce their own three video game cabinets, which were based on imported components. We assume that one of these three, which was called *Mörkö* (Boogeyman), was actually *Pac-Man* because the other two, *Gorilla* (*Donkey Kong*) and *Galaksi* (probably *Galaxian*), were also

based on popular arcade hits. RAY later produced some other games as well (Kortelainen 1988, 240). In addition to this, there were other, original *Pac-Man*-related arcade cabinets in operation at Finnish arcades, such as *Baby Pac-Man* (released by Bally-Midway in October 1982, but not authorized by Namco), a hybrid between a video game and pinball machine, and likely also *Ms. Pac-Man*. (Picture of *Baby Pac-Man*, *Potti* 3/1983, 3.) A very typical place for Finns to first start playing video games, was on the tourist ferries between Finland and Sweden, where one was able to play various arcade and slot games in the early 1980s.

Only a minority of Finns had played (arcade) video games in the early 1980s. According to RAY's own survey in Autumn 1983, 16% of 15–74 year old Finns had tried arcade or video games (or "TV games" as they called them). The players were mostly young men who did not play games often and spent only a little money on them. (*Potti* 2/1984, 3–5.) Even though the amount of players was smaller than with other RAY games, such as slot machines and *Payazzo*, the Finnish Slot Machines Association paid attention to the increasing global popularity of arcade games and, for example, covered the new market trends in its publications, also referring to the popularity of *Pac-Man* (all translations from Finnish by the authors):

> The Japanese answered this [American competition] with a simple maze game, called *Pac-Man*. Its inventor is the 25 year old game designer from Namco, Toru Iwatani. For the producers of home video games alone, *Pac-Man* made a profit of about 800 million Finnish Marks, which is more than the entire Volkswagen corporation did. (*Potti* 3/1983, 4, "Video conquers but where did it come from?")

RAY observed the overheating of the video game market in 1983, when the popularity of arcade games also decreased in Finland, after which their decline can most likely be attributed to the rise of home computers. (*Potti* 4/1984, 6–7; Kortelainen, 1988, 239–240.)

Finns also got to know *Pac-Man* via video game consoles and home computers, even though the penetration of consoles was very low in Finland because of the high prices of the devices and game modules, and because of consoles' limited usability compared to home computers (Suominen 2015). Home computers quickly became the main platform for playing digital games. However, in early 1983, Atari organized a marketing tour around Finnish cities, where it held national *Pac-Man* championships semi-finals as well as introduced the Finnish cover version of the *Pac-Man Fever* song (1982), translated as *Pac-Man kuume* (*Micropost* 2/1983, 40–41; *Katso* 25.4.1983, no. 17). Even though the cover version didn't achieve any particular popularity, it shows how *Pac-Man* started becoming a popular cultural icon beyond just being a game in Finland as well.

Although *Pac-Man*'s position as a primary icon of video game culture was strengthened later, the game was generally already familiar to Finnish gamers in 1983, and the *Pac-Man* character could be recognized even by those who did not actively play video games. For a rookie programmer, *Pac-Man* was a more easily approachable target compared to, for instance, driving simulators or space shooters, because it lent itself well to the character graphics typical of the early home computers of the 1980s. *Pac-Man*-like games and similar experiments were published and circulated by, among others, hobbyist magazines and computer clubs.

STAVROS FASCOULAS

PAC-MAN VICILLE

Ohjelma on versioni videopelistä PAC-MAN. Kun peli käynnistetään komennolla RUN, ilmestyy kuvaruutuun eräänlainen "labyrintti". Keskelle ilmestyvä pallo on oma "ukko". Ja sitä voi liikutella alkumusiikkien jälkeen näppäimillä W, A, D ja X neljään eri suuntaan. Tarkoituksena on syödä 65 kentällä olevaa pistettä, jotta pääsisi kentästä läpi. Tätä syöntiä on kuitenkin vaikeuttamassa 3 "vihollista", jotka yrittävät ottaa oman "ukon" kiinni ja syödä sen. Pelastus löytyy kuitenkin kentän oikeasta alanurkasta: korttipakan ruutu "herkkupiste tai energiapilleri". syömällä tämän voi oma "ukko" hyökätä vihollisten kimppuun ja syödä niitä niin pitkään kuin aika riittää (aika näkyy kentän oikealla puolella). Poistamalla lauseet 81 ja 82 saadaan ääni pois (ei alkumusiikkia) ja peli nopeutuu vähän.

Figure 2. Program code published in MikroBitti 1/1984, 70.

Melanie Swalwell (2008, 193), who has studied computer hobbyist and video game cultures in New Zealand and Australia in the early 1980s, argues that writing program code "was a

key part of the reception and culture of early home computers." Graeme Kirkpatrick (2012) also points out, based on his studies on game magazines and game cultures in the UK in the 1980s, that "people who played games on home computers at the start of the decade, the game object was apprehended as a piece of code." In Finland, as in many other countries, the practice of publishing game source code was initially started by university students and early computer clubs. Program listings were an important part of the club magazines that emerged in the late 1970s and early 1980s (e.g. *Tieturi*, the club magazine of Telmac microcomputer users). Games obviously provided their own entertainment value, and clubs started to organize game evenings and competitions (Saarikoski & Suominen, 2009, 4–5). These activities became more popular in the early 1980s when new, young enthusiasts joined the clubs and new clubs were founded. For example, *Helsingin seudun Vic-kerho* (Helsinki Region VIC-20 Club) had 100 members in early 1983, and before it changed its name to *Commodore-Mikroharrastajat* (Commodore User Club) in February 1985, the number had already grown to 605, of which 20% of its members were children under fifteen years of age. (*Vikki* 2/1983, 3–4; *Printti* 7/1985, 3.)

The publication of program listings in professional computer magazines and specialized electronics magazines became a common practice in the early 1980s. The most popular magazines of the time were *Prosessori* (Processor, 1979–2011), *Tietokone* (Computer, 1982–2014), and *Elektroniikkauutiset* (Electronics News, 1972–1984). While the first listings were just short snippets of code, after 1982, their proportion of the total page count began to grow. (Interviews with Eskoensio Pipatti June 17, 1998; Lauri Kotilainen June 3, 1998.) This took place at the same time as the first mass-produced microcomputers, often simply classified as *home computers,* entered the Finnish consumer market in 1982 and 1983 (Saarikoski, 2004, 81–82; Saarikoski & Suominen, 2009, 5).

Although the Sinclair ZX-81 gained some popularity, the Commodore VIC-20 clearly dominated the early "micro boom" for two years. The VIC-20 was first introduced in April 1982 as "the first true home computer" (*Prosessori* 4/1982, 71–73). According to some estimates, over 20,000 units were sold in 1982–1983 (*Vikki* 1/1984, 5). After 1984, the Commodore 64 began to gain popularity and became the dominant home computer in Finland for the remainder of the 1980s. Even so, the VIC-20 was remembered as the first home computer, which many future programmer talents like the developer of Linux, Linus Torvalds, used for their programming practice. Considering the market situation in 1982, it was only natural that Stavros Fasoulas also used a VIC-20 when he created his own version of Pac-Man. (Saarikoski, 2004, 101–102.)

In the Finnish consumer market, commercial computer games were almost nonexistent until the early 1980s. Technically speaking, the sales of Finnish home computer games started in 1979, but activity remained very low over the following five years (Reunanen & Pärssinen, 2013; Reunanen, Heinonen & Pärssinen, 2014). The importation of games – mostly from the UK – started slowly in 1982, led by small-scale mail-order firms. The May 1984 market reports indicate that there were some 30 commercial games available for the VIC-20 at that time. Judging by the sales figures, importers usually focused on the most popular titles available (for example, *Jupiter Lander*, *Choplifter*, *Frogger*, *Omega Race*, *Radar Rat Race*, *Gorf*, *Avenger* and *Pac-Man* clones). The same games can also be seen in the magazine readers' sales classifieds sections. (*MikroBitti* 1/1984, 13; *Vikki* 5/1983, 8; *Vikki* 6/1983, 1.)

Until the mid-1980s, there was a constant shortage of commercial game titles and thus a clear demand for game program listings remained. A similar problem existed in other countries as well until commercial game programming started meeting consumer needs. For example, in the UK, a wide variety

of games was already available in 1982 (Kirkpatrick, 2012; Kirkpatrick, 2016). Typically, most of the games programmed by hobbyists and published by club and computer magazines were variants of popular card and board games (hangman, battleship, chess, tic-tac-toe, poker, *Mastermind,* and *Yatzy*). It is evident that hobbyists continued the old tradition established in the 1970s, where program listings were copied and modified from other magazines (domestic and international), handbooks, and software libraries.

On commercial computer magazines, the original source (typically a well-known international publication) was usually mentioned, and program listings included basic documentation about the major changes that had been made to the newly published listing. This kind of activity was, however, rare in non-commercial club publications, as they were less concerned about such attribution. In some cases, only the original idea had been used, and the programmer had come up with the implementation independently. In addition, there were games that can be considered truly original and innovative. (*Tieturi* 6/1982, 8–9; *Prosessori* 11/1982, 82, 102; *Prosessori* 9/1983, 83; *Tieturi* 2/1983, 15–16; *Vikki* 4/1983, 18–19.)

Software copyright issues were sometimes discussed in club meetings, and some organizers also paid attention to Finnish copyright laws. For example, Lauri Hirvonen from the *VIC-20 User Club* stated in early 1984 that the law protected program code and that stealing was, therefore, illegal. Ideas and the basic structure could be copied if the programmer did considerable changes to the original code. (*Vikki* 1/1984, 3–4.) These kinds of discussions mainly focused on cases where hobbyists "stole" code from other hobbyists. The copying of commercial software was not mentioned in the article, but it was already a well-known practice among the hobbyists in the 1970s. Software piracy (the cracking and distribution of commercial games) had already sparked some heated media debate in the mid-1980s. Copying

games became extremely easy when new hardware, such as disk drives, became popular. (Saarikoski, 2004, 320–324; Saarikoski & Suominen, 2009.) There were similar discussions in commercial computer magazines, and editors conducted some background checks to make sure that programs had not been published somewhere else. There were cases where hobbyists offered programs where they had just added their own name without making any changes to the original code, but magazines had zero tolerance for these attempts. (Interview with Eskoensio Pipatti June 17, 1998.)

The cloning of commercial games was an internationally well-known side-effect of the developing industry in the 1980s. Game companies – especially small ones – were keen to copy basic concepts from the most popular titles and make their own versions of them. Classic arcade and video games (for example *Pong*, *Breakout*, *Frogger*, and *Pac-Man*) were quickly cloned for the home computer markets. Therefore, it is natural that similar cloning was also practiced by computer hobbyists (Saarikoski & Suominen, 2009). Cloning was also a way of practicing programming, much like how art students create copies of famous paintings and other works (Suominen, Reunanen & Remes, 2015).

Published program listings offer a view of how the original *Pac-Man* was appropriated and modified by the hobbyist community. Early clones made by enthusiasts were simple maze games with some recognizable *Pac-Man*-like features. One of them was *Zac-Man*, coded by Antti Hakkarainen for the VIC-20 (*Tietokone* 1/1984, 58–59). The author modestly referred to *Pac-Man* as a "big brother" of this maze game "even though it may not have all the characteristics of the original." Even simpler variants were available for the ZX-81. In Mika Helsingius' *Sokkelopeli*, published in *Tietokone* 3/1984, the purpose was "to eat all the stars [in the labyrinth] and at the same time watch out for a monster who tries to swallow you." Another example was

Mörköpeli by Alpo Hassinen (*Tietokone* 8/1984, 68–69), although the author explained that it was "not a Pac-Man clone because the idea of the game was totally different." One more interesting example is *ZX Man* from the *Micropost* magazine, which included a short article about *Pac-Man* clones, and some details about the history of the game and its father Toru Iwatani (*Micropost* 3/1983, 6–7).

There are no listings for *Pac-Man* clones in the *Vikki* club publication. The reason for this absence is perhaps very simple: club members lamented that game programming was surprisingly difficult and, therefore, they had not been able to publish "good enough games." Furthermore, the poor print quality of the magazine did not provide for lengthy program listings. In spite of the problems, there are a couple of examples of simple maze action games, called *Virgo* and *Sarvipäät* [Horn heads], both the creations of Juha Ojaniemi. (*Vikki* 5/1983, 11; *Vikki* 6/1983, 31.)

Commercial clones were available and already known about early on. The most popular *Pac-Man* clones were *Jelly Monsters* (Commodore, 1981) and *Snackman* (Tom Mix Software ltd., 1983). *Pac-Man* was introduced in the *Vikki* magazine as the "the world's most popular micro computer game," and *Snackman* was reviewed as an example of a low-quality *Pac-Man* clone. (*Vikki* 6/1983, 16; *Vikki* 7/1983, 7.) In contrast, *Jelly Monsters* received more positive feedback and was also played at game competitions (known as the "Finnish VIC Game Championships") arranged by the club. The obvious purpose of the competitions was to attract more young members to the club. (*Vikki* 4/1983,1, 6; *Vikki* 1/1984, 16; *Vikki* 2/1984, 20.)

After 1983, the Finnish home computer market was clearly booming. Two home computer magazines, *MikroBitti* and *Printti*, were founded in 1984. Of these two, *MikroBitti* was the more popular publication and for many years remained the only

Finnish magazine that wrote extensively about computer games. (Saarikoski, 2004; Saarikoski & Suominen, 2009; Reunanen, Heinonen & Pärssinen, 2013.) Editor-in-chief Lauri Kotilainen has stated that founding the magazine took place on a tight schedule, and that the editorial staff desperately sought articles and writers. Some of the content was taken from articles originally offered to *Prosessori* and *Tietokone* (both of which were, like *MikroBitti*, published by Tecnopress, which was then sold to Sanoma Oy in January 1984, before Kotilainen left the company after May 1984). In particular, there was a need for game journalism and program listings, which were known to attract young potential readers. The editors noticed the popularity of *Pac-Man* clones, and the game itself was already labelled "a classic." (Interview with Lauri Kotilainen, June 3, 1998.) In the light of this, it is understandable that *Pac-Man for the VIC-20* was given a visible place in the listings section of the first issue.

More information about the history of the game is very scant, partly because Fasoulas has never mentioned it in his scarce interviews, or published any memoirs or articles on his career. The details of his personal history are equally obscure. What is so far known is based on a few newspaper and game magazine articles (*MikroBitti* 12/1986, 5; *C-lehti* 3/1987, 5). Fasoulas became interested in home computers in 1982, when he learned the essentials of the BASIC programming language at school. The year 1982 is also important because it is when IT classes were first introduced in the Finnish high school curriculum. In addition to the formal program, many activities revolving around computers and programming took place in after school computer clubs (Saarikoski, 2011).

BASIC programming exercises had some early impact on how Fasoulas, at the age of 14, become familiar with game design. From 1982 to 1984, he mainly used his friend's VIC-20 to learn machine language, however, during 1984 he started to exclusively use the Commodore 64 purchased by his father.

(*MikroBitti* 12/1986, 5; *C-lehti* 3/1987, 5.) Therefore, it is highly possible that the *Pac-Man* clone was a result of his schoolwork – the date mentioned on the listing is September 12, 1982. The game was introduced as "my version of Pac-Man" and, rather curiously, the title of the original game was not hidden despite potential copyright issues. To our knowledge, no complaints were filed by anyone afterwards. It is not known how well the game was received by the readers, although there is some criticism of the low print quality in letters to the editor (*MikroBitti* 2/1984, 25).

Fasoulas' game can be seen as an interesting example of the early stages of game culture in Finland. It remains the first and last *Pac-Man* clone published by *MikroBitti*. The Commodore 64 was gaining more popularity, and hundreds of new commercial games became available during 1984. *Pac-Man* clones began to lose popularity, and just before Christmas 1984, Petri Helenius wrote in *MikroBitti* 4/1984: "Pac-Man copying should stop for good, or otherwise the whole home computer world will drown in the flood of these clones." The same kind of "clone problem" was noted in *Printti* (3/1985, 10). Critical reviews like this and the disappearance of clones from printed BASIC listings indicate that the magic of *Pac-Man* as the "world's best computer game" was already starting to fade.

READING THE CODE

As the source code of *Pac-Man for the VIC-20* is available in a human-readable form, it is possible to look deeper into how it was implemented. The *MikroBitti* page, of course, contains the full source, but it was more convenient to de-tokenize an already existing BASIC file with *petcat*, a command line tool that is part of the ubiquitous *VICE* (Versatile Commodore Emulator) package that allows users to emulate a number of different 8-bit Commodore computers ranging from the PET to the C-128 (cf. Newman, 2012, 140–145). In the process, we also discovered

another revision of the game, which utilizes the joystick instead of the keyboard in the same way that the published version did. It is currently unknown which of them is older, and whether the joystick version was made by Fasoulas at all, because there are no credits to be found. Apart from the control scheme and credits, the two versions are identical.

First and foremost, the game runs on an unexpanded VIC-20 with a 1.1 MHz 8-bit 6502 processor (in its PAL variant). The standard screen dimensions are 22 by 23 characters of 8 by 8 pixels each – it is possible to extend the screen beyond that, but *Pac-Man for the VIC-20* sticks to the default size and does not modify the character set. It would be possible to set a separate foreground color for each character position, but the game does not utilize that feature either, resulting in monochromatic graphics. Secondly, there is the layer of the *CBM BASIC V2* between the program code and the hardware, which makes certain things easy and accessible, but also slows down the execution speed to a great extent (cf. Montfort & Bogost, 2009, 147–150).

The first impression one gets when trying out the game is that it is rather frustrating to play: Pac-Man moves sluggishly and running away from a trailing "ghost" (the spades in Figure 1) is almost impossible. A closer look at the code reveals that the enemies do not actually move in a uniform way, but that there are minor variations in their logic, as there were in the original game (cf. Newman, 2016). The goal is not to empty the level, unlike in standard versions, but rather to collect 65 dots. The slow speed is easily explained by the fact that there is no machine language involved at all; arcade games could not typically be written in BASIC, as they required faster interaction than was possible with the interpreted language of the time. The endless incomprehensible DATA statements with numbers, as seen in many other game listings, are in fact machine language encoded into BASIC statements.

On the one hand, Fasoulas' *Pac-Man* clone is unavoidably slow because of the underlying software platform, while, on the other hand, it is an example of pushing the boundaries of what is possible in the first place. Multiple details reveal how the programmer has understood and worked around the limits of the BASIC interpreter, choosing the fastest and most convenient way of doing things. First of all, the code is condensed: all of the unnecessary whitespace is removed, variable names are minimally short, and the lines are populated with multiple BASIC statements in order to maximize the speed. There are no multiplications or divisions in the whole program. Dealing with any numbers is inherently slow because the interpreter always uses floating point numbers that are not natively supported by the 6502 processor.

Similar purposefulness is prevalent in all of the code. The playfield, with its walls and food pills, is displayed by a visually recognizable group of simple PRINT statements, whereas moving the enemies or the player is done by POKE statements that directly access the screen memory (memory addresses 7680–8185 correspond to character location on the screen). It should be noted that *CBM BASIC V2* is very limited in many respects: there is no support for reading the joystick, setting the cursor position, or even playing back sound. To achieve any of them, the programmer must resort to using PEEK and POKE statements that manipulate the memory addresses dealing with the hardware state. For example, the music that plays at the beginning of the game consists of a loop that POKEs plain numbers to address 36876, which controls oscillator 1.

When starting up, the VIC-20 informs the user that there are 3,583 bytes of free memory. After loading or typing in the game, there are only around 200 bytes left (depending on the version). In other words, effectively all the available memory is in use. There is no space for storing a copy of the playfield with its walls and corridors, so the game uses the screen memory for its

bookkeeping: we can think of the screen as both game visuals and a representation of the internal logic. The locations of the player and the ghosts are stored as direct screen memory addresses instead of something human-readable, such as screen x/y coordinates. With 22 by 23 characters on the screen, incrementing the address by 22 will move a ghost down by one row.
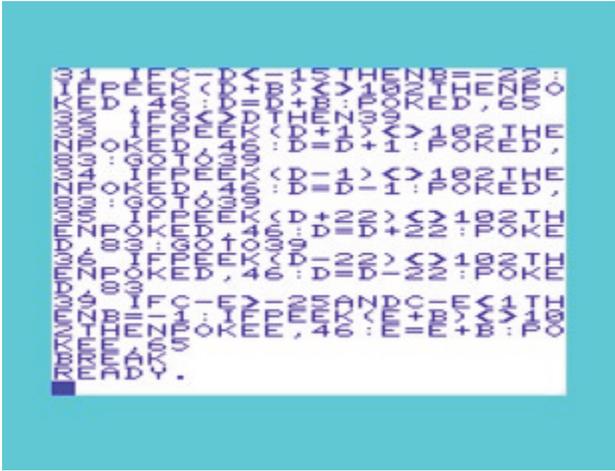
Figure 3. Part of the listing shown on an emulated VIC-20 screen.

As can be seen in Figure 3, the source code of the *Pac-Man* clone is not easy to read on a real VIC-20 computer. Part of the bad readability follows from the need to optimize the speed, while some of the difficulties with readability can further be attributed to how the listing is fitted into the limited space of the printed magazine. The low resolution of the characters does not help either: lines of BASIC code are spread across multiple screen lines, keywords are broken in the middle and, overall, only a small portion of the code can be viewed at a time. With all this in mind, it is again necessary to ask what real purpose the listing served – the resulting game would not offer long-lasting entertainment, and reading uncommented cryptic statements would hardly improve anybody's programming skills. It is more

likely that the joy of typing on a computer and getting something "real" out of the effort was rewarding enough in itself. From a commercial perspective, program listings were cheap content for magazines, as recalled by *MikroBitti's* editor-in-chief Eskoensio Pipatti (Interview with Eskoensio Pipatti June 17, 1998).

CONCLUSION

Pac-Man for the VIC-20 highlights a number of characteristics and challenges of the booming computer hobbyist culture of the early 1980s. The initially short supply of available software was alleviated by enthusiasts' own efforts in the form of code snippets and simple games – often clones of existing board and arcade games, as shown above. The main motive for creating such low-quality games was, first and foremost, social. For a young computer programmer such as Stavros Fasoulas, the publication of one's own game in a commercial home computer magazine was undoubtedly an important personal achievement. Getting your program into a magazine like *MikroBitti* made it available to thousands of like-minded readers, which was quite a feat before the age of easily accessible communication networks.

Even if the games did not necessarily provide lasting entertainment per se, creating them let aspiring programmers learn the first necessary steps on their way to more complex undertakings and, as in the case of Fasoulas, eventually a career. Other than that, game listings did not play any significant role in the history of the early Finnish game industry. From the publishers' point of view, program listings were mainly just cheap yet surprisingly popular content. In addition, they offered a means of interchange between readers and the magazine. Computer magazines or club publications did not limit the artistic freedom of the programmers: editors usually picked the best and most suitable titles for each issue. The only rule was that programmers were not allowed to offer content that had been published before.

Looking into the *Pac-Man* clone brought up the problematic definition of a "platform." On the one hand, there is the hardware platform, the VIC-20 with its particular characteristics, but, on the other hand, the program in question runs on the built-in BASIC interpreter, which introduces its own peculiarities, such as a selection of useful ready-made functions and the slow execution speed (compared to machine language). In other words, we are clearly dealing with two, not just one single, platforms here. Furthermore, as seen in Fasoulas' game and a number of other similar listings, there was a notable trend of bypassing the BASIC interpreter altogether for the sake of speed and full access to the hardware – working, not *with*, but rather *around* the offerings of the software platform.

From today's perspective, it already looks rather strange and archaic that the main user interface of a computer was a programming language. The ubiquitous BASIC interpreter was available to most home computers, such as the popular 8-bit Commodore machines and thus strongly characterizes one generation of computing. From a software perspective, it can be considered a somewhat uniform layer that hid the underlying colorful and mostly incompatible hardware of the 1980s. Since then, we have gained much more powerful gadgets and friendly user interfaces, yet something has also been lost in the process. Programming, which used to be a natural use for a computer, vanished from the mainstream for almost two decades and is only now gaining back its aura as a skill that is of use to even non-technical people.

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REFERENCES

Interviews (interviewed by Petri Saarikoski)

Eskoensio Pipatti June 17, 1998

Lauri Kotilainen June 3, 1998

Magazines

C-lehti 1987

Katso 1983

Micropost 1983

MikroBitti 1984–1986

Potti 1980–1984

Printti 1985

Prosessori 1982–1983

Tieturi 1982–1983

Vikki 1983–1984

Zzap! 64 1986

LITERATURE

Bogost, I., & Montfort, N. (2009). Platform studies: Frequently questioned answers. In *Proceedings of the digital arts and culture conference 2009.* Irvine, California: University of California.

Fuller, M. (2008). *Software studies: A lexicon*. Cambridge, Massachusetts: MIT Press.

Kirkpatrick, G. (2012). Constitutive tensions of gaming's field: UK gaming magazines and the formation of gaming culture, 1981–1995. *Game studies: The international journal of computer game research*, 12.

Kirkpatrick, G. (2016). How gaming became sexist: a study of UK gaming magazines 1981–1995. *Media, culture & society*, April 30th 2016.

Kortelainen, J. (1988). *Pajatso ja kansanterveys: Raha-automaattiyhdistys 1938–1988*. Raha-automaattiyhdistys. Helsinki: WSOY.

Kuorikoski, J. (2014). *Sinivalkoinen pelikirja: Suomen pelialan kronikka 1984–2014* [Blue and white game book: The chronicle of the Finnish game industry 1984–2014]. Saarijärvi: Fobos kustannus.

Montfort, N., Baudoin, P., Bell, J., Bogost, I., Douglass, J., Marino, M.C, Mateas, M., Reas, C., Sample, M., & Vawter, N. (2013). *10 PRINT CHR$ (205.5+RND(1)); : GOTO 10*. Cambridge, Massachusetts: MIT Press.

Montfrot, N, & Bogost, I. (2009). *Racing the beam: The Atari video computer system*. Cambridge, Massachusetts: MIT Press.

Newman, J. (2012). *Best before: Videogames, supersession and obsolescence*. Abingdon: Routledge.

Newman, J. (2016). Mazes, monsters and multicursality. Mastering Pac-Man 1980–2016. *Cogent Arts & Humanities*, 3(1).

Nylund, N. (2016). The early days of Finnish game culture:

Game-related discourse in Micropost and Floppy magazine in the mid-1980s. *Cogent Arts & Humanities*, 3(1).

Reunanen, M., Heinonen, M., & Pärssinen, M. (2013). Suomalaisen peliteollisuuden valtavirtaa ja sivupolkuja [Mainstrean and byways of the Finnish game industry]. In J. Suominen, R. Koskimaa, F. Mäyrä, P. Saarikoski & O. Sotamaa (Eds.), *Pelitutkimuksen vuosikirja 2013* [Yearbook of Finnish game studies 2013] (pp. 13–28). Tampere: University of Tampere.

Reunanen, M., & Pärssinen, M. (2014). Chesmac: Ensimmäinen suomalainen kaupallinen tietokonepeli – jälleen [Chesmac: The first commercial computer game in Finland]. In J. Suominen, R. Koskimaa, F. Mäyrä, P. Saarikoski & O. Sotamaa (Eds.), *Pelitutkimuksen vuosikirja 2014* [Yearbook of Finnish game studies 2013] (pp. 76–80). Tampere: University of Tampere.

Saarikoski, P. (2004). *Koneen lumo. Mikrotietokoneharrastus Suomessa 1970-luvulta 1990-luvun puoliväliin* [The lure of the machine. The personal computer hobby in Finland from the 1970s to the mid-1990s]. Research Centre for Contemporary Culture. Jyväskylä: University of Jyväskylä.

Saarikoski, P., & Suominen, J. (2009). Computer hobbyists and the gaming industry in Finland. *IEEE Annals of the History of Computing*, 31(3), 20–33.

Saarikoski, P. (2011). Computer courses in Finnish Schools during 1980–1995. In J. Impagliazzo, P. Lundin & B (Eds.), *HiNC3, 3rd IFIP WG9.7 Working Conference on History of Nordic Computing* (pp. 150–158). Berlin: Springer.

Suominen, J. (2010). "Pieni askel ihmiskunnalle, mutta jättiharppaus tietokoneistetuille roolipeleille": MikroBitti-lehden peliarvostelut pelaamisen historiatietoisuuden rakentajina 1984–2008 [Game reviews of the MikroBitti magazine as constructors of historical awareness in 1984–2008].

In J. Suominen, R. Koskimaa, F. Mäyrä & O. Sotamaa (Eds.), *Pelitutkimuksen vuosikirja 2010* [Yearbook of Finnish game studies 2010] (pp. 83–98). Tampere: University of Tampere.

Suominen, J. (2015). Suomen ensimmäinen konsolipelibuumi 1988–1994 tietokonelehdistön ja pelaajien muistitiedon kautta tarkasteltuna. [The first console gaming boom in Finland 1988-1994 from the perspectives of computer hobbyist press and oral history of players] In R. Koskimaa, J. Suominen, F.Mäyrä, J. T. Harviainen, U. Friman, J. Arjoranta (Eds.), Pelitutkimuksen vuosikirja 2015 [Yearbook of Finnish game studies]. University of Tampere, Tampere, http://www.pelitutkimus.fi/vuosikirja2015/artikkeli-suomen-ensimmainen-konsolipelibuumi-1988-1994-tietokonelehdiston-ja-pelaajien-muistitiedon-kautta-tarkasteltuna.

Suominen, J. (2016). How to present the history of digital games: Enthusiast, emancipatory, genealogical and pathological approaches. *Games & culture*, preprint, June 20, 2016, doi: 10.1177/1555412016653341.

Suominen, J., Reunanen, M., & Remes, S. (2015). Return in play: The emergence of retrogaming in Finnish computer hobbyist and game magazines from the 1980s to the 2000s. *Kinephanos – Canadian journal of media studies.* Retrieved from http://www.kinephanos.ca/2015/emergence-of-retrogaming/

Suominen, J., & Sivula, A. (2016). Participatory historians in digital cultural heritage process – Monumentalization of the first Finnish commercial computer game. *Refractory – Australian journal of entertainment media*, 27(1). Retrieved from http://refractory.unimelb.edu.au/2016/09/02/suominen-sivula/

Swalwell, M. (2008). 1980s Home Coding: The Art of Amateur

Programming. In S. Brennan & S. Ballard, *The Aotearoa digital arts reader* (pp. 193–201). Auckland: Aotearoa Digital Arts and Clouds.

Swalwell, M. (2009). Towards the Preservation of Local Computer Game Software. *Convergence: The international journal of research into new media technologies*, 15(3), 263–279.