

The Human Machine Art Interface: Arcade Port Aesthetics and Production Practices

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ABSTRACT

This research focuses on the aesthetic properties and production processes of arcade to home computer game ports during the 1980s and 1990s, in particular arcade titles originating in Japan that were licensed by UK based software houses for the 8-bit and 16-bit microcomputer market.

The conversion teams worked within the unique constraints of 6 main platforms, namely the ZX Spectrum, Amstrad / Schneider CPC, Commodore 64, Atari ST, Commodore Amiga, and MS-DOS PC. In all the examples discussed, the original arcade cabinet was used as the core audiovisual and gameplay reference.

As a human mediated process, the conversion of the digital material of arcade game to home computers not only bore the audiovisual constraints of the target platforms, but also the creative signatures of the conversion teams. The most successful home ports succeeded in capturing the essence of the arcade originals, while positively augmenting the gameplay, narrative, and overall aesthetic.

Keywords

arcade, home computer, video game, art, aesthetics, port, conversion, platform

INTRODUCTION

This paper concentrates on the creative processes and aesthetic properties, both audiovisual and interactive, of arcade to home computer game conversions in the 1980s and 1990s. It focuses mainly on arcade games licensed by third party developers for conversion to western 8-bit and 16-bit microcomputer platforms by UK based software houses, with findings based on first hand interaction with home arcade ports, alongside developer interviews sourced from video game magazines of the period.

The release roster for the home conversions of Capcom's *Street Fighter II: The World Warrior* (1992, 1993) by UK based game development and publishing studio U.S. Gold is representative of the European home computer market of the time, with ports of *SF2* released across six main home platforms (table 1). Three of these were 8-bit systems, the Sinclair ZX Spectrum, Commodore 64, and the Amstrad / Schneider

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CPC, each with cassette and diskette media options. The Atari ST and Commodore Amiga were the staple 16-bit target markets, with MS-DOS based PC compatibles gaining greater momentum in the early 1990s. This broad range of platforms, each with significantly different computational architecture, storage media, control systems, and audiovisual capabilities resulted in each arcade license undergoing multiple reinterpretations.

Platform	Processor Architecture	RAM	Graphics	Sound	Storage Media
Commodore Amiga	16-bit, Motorola 68000, 7mhz and higher	512kb base	64 colours onscreen max (EHB mode), 4096 (HAM mode), 320 x 256, 640 x 256, 640 x 512 (pal).	4 PCM channels.	720kb floppy, optional HD.
Atari ST	16-bit	512kb base	16 colours, 320 x 240. 4 colours, 640 x 200, mono 640 x 400.	3 voice square wave, 1 voice noise generator.	Single side 360kb floppy, HD.
MS DOS IBM PC Compatible	16-bit. Baseline Intel 8086 at 4mhz	IBM PC Jr base RAM: 64kb.	256 colours max, 320 x 200 (VGA), 16 colours, 640 x 350 (EGA), 4 colours, 320 x 240 (CGA), mono, 720 x 348 (Hercules).	PC Beeper as standard, optional sound card.	Floppy, HD.
Commodore 64	8-bit, 6510, 1.023mhz	64kb.	16 colours, 160 x 200.	SID sound chip, 4 channels.	Cassette, Diskette.
Amstrad / Schneider CPC	64kb	64kb, 128kb	16 colours, 160 x 200, 4 colour 320 x 200, 2 colours 640 x 200.	3 channel square wave and white noise generator.	Cassette, Diskette.
ZX Spectrum	Z80 at 3.5mhz	48k, 128k	256x192, 15 colours.	Beeper (48k model), 3 channel FM synth (128k version).	Cassette, Diskette.

Table 1: Comparison chart of technical specifications for the six main home computer platforms targeted by UK based software houses including Ocean, U.S. Gold, and Graftgold in the late 1980s and early 1990s.

Developer interviews with the teams behind the home conversions of *Forgotten Worlds* (1989), *Rainbow Islands* (1989), *Midnight Resistance* (1990), *Snow Brothers* (1991), and *Mercs* (1991) from sources including *The One* and *Commodore User* magazines each detail the use of the original arcade cabinets as the main reference material, rather than reliance purely on provided digital assets and design documents.

The referenced magazine interviews were originally published to stoke anticipation for upcoming releases, and are wrote in collegial tones, at times downplaying the limitations of the target systems. For example when discussing the redrawn graphics for *Forgotten Worlds* on the Amiga, South remarks “In some cases (including the close-up faces) the Amiga graphics are arguably superior” (1989, 24). Despite any platform-centric biases evident, as historical documents the developer interviews provide valuable records of the creative, technical and business processes undergone by the teams involved.

In interview with veteran game developer Jas Austin, Gazzard links the decline in production of arcade clones for British home micros in the mid-1980s with the beginnings of licensed arcade home conversions for the UK market (2014). This change coincided with mounting pressures placed on the industry by original arcade IP owners. Gazzard’s journal article also draws direct parallels between the development of arcade clones and official arcade to home ports, with copying from visual references forming the backbone of the production process for both game types (ibid).

The developers of each arcade to home conversion case considered in this paper laboriously recreated their source material by directly referencing the arcade screen. This process used eye to hand artistry to reproduce the game graphics, often augmented by the use of video camera based frame capture units trained directly at the arcade cabinet’s CRT. By using video capture, additional visual aspects such as spatial distortion from the curve of the arcade monitor, camera lens distortion, capture device resolution, and file compression artefacts are combined with the artists own style, adding additional layers of graphical filtration.

Although the original developers were willing to assist the conversion team, the use of snail mail to distribute digital assets often clashed with deadlines, alongside issues of file compatibility, leading to the conversion team forging ahead with most if not all of their game graphics from scratch. The language barrier between Japanese and English speaking developers was also a factor, with the developers of the Amiga and Atari ST versions of *Rainbow Islands* (1989) reinterpreting the games music by listening directly to the coin op rather than translating the paper based music notation supplied by Taito (Penn 1989, 16).

When machine imposed storage and processing restrictions were combined with manual approximation of game logic and assets, the resulting home computer ports often had considerable aesthetic changes from their original arcade source. These changes manifested not just in terms of the visual look and feel alongside the game audio, but also in terms of the gameplay flow and narrative.

FROM THE ARCADE TO YOUR COMPUTER

A magazine advertisement by Image Works for their 1989 home conversion of *Blasteroids*, originally release for the arcades by Tengen in 1987, emphasises

airbrushed artwork and an image of the original coin-op cabinet, with in-game screenshots sidelined to a column on the left of the page (figure 1). The copy boasts of the accurate reproduction home ports' gameplay features, "straight from the arcades comes *Blasteroids*. Tengen's class is mix of one or two player action. With full power-ups, rip-stars, shields double-up and more, this is the coin-op of 1989" (The One 1989, 9).



Figure 1: *Blasteroids* magazine advertisement by Image Works (1989).

The featured screenshots are from the Commodore Amiga version, the most graphically advanced of the home systems this port was published to, yet the included screen captures are low quality and do not adequately convey the game's visual quality, hence the use of the airbrushed artwork as a selling point. As a supporting paratextual element, this hand rendered game artwork presents the idealised version of the game environment that supporting platforms of 1989 could not match.

Similarly the advertising copy for Ocean Software's home conversions of *Operation Wolf* relies heavily on airbrushed artwork, taglines, and reviewer praise to drive home to potential customers that the home versions of the arcade game capture the essence of the arcade experience (figure 2). *Operation Wolf* is an on the rails shooter, played in a stand up custom cabinet via an Uzi shaped controller. It was released across 5

main computer platforms for the European market, with a PC version developed and released by Taito for the North American market.



Figure 2: *Operation Wolf* magazine advertisement by Ocean (1989), featuring artwork by Bob Wakelin.

“Six levels of thrilling coin-op action brought to life on your home micro. All the original arcade play features - magazine reloads, energy bottles, hidden supplies, rocket grenades and more... much more!” A quote from ACE magazine backing up this assertion at the base of the page is given a prominent typeface “Not only has all the action and gameplay been captured, but so has the excitement, making it one of the most satisfying and compulsive shoot-em-ups to have appeared in a long time” (The One, 1989, 83).

The featured screenshots are photographs of the arcade version, evident from the curve of the cathode ray tube screen and their colour palette. No images are shown of the home ports been advertised, hence the emphasis given to the reviewer endorsements. Bob Wakelin’s airbrushed artwork takes centre stage, reworking the original game logo into a striking metallic 3d logotype, with the anonymous protagonist taking aim directly at the reader. The original Taito *Operation Wolf* logo

is relegated to the lower left of the screen, under the arcade screenshots and cabinet image, such is the confidence of the home conversion's identity.

When separated from the original coin-op hardware, *Operation Wolf* switches from playing in a stand up position with a custom Uzi gun controller, to using keyboard, joystick, or mouse in a (normally) seated position. The former two control methods create a greater level of difficulty as the player fights the crosshairs inertia. Lightgun support was included for later editions of the 8-bit computer ports bringing the home computer experience closer to the arcade original.

Despite the change of manual control device, each home release competently recreates the onscreen feedback mechanism of the arcade original's heads up display. *Operation Wolf*'s HUD is notable for its communication of tension, with the depletion of each ammo clip represented by a fast disappearing grid of bullet icons, separated from the periphery of the game field by a pulsing damage meter (figure 3).



Figure 3: *Operation Wolf* arcade screenshot, the visual feedback in the HUD indicates high damage and three remaining ammunition clips.

The 8-bit versions made necessary adjustments to the onscreen layout to compensate for resolution differences and processing power, with the Commodore 64 port (figure 4) relocating part of the feedback HUD underneath the gameplay area. While the 8-bit graphics are manually redrawn rather than digitally downsampled from the originals, when presented alongside the HUD the overall composite view retains a look and feel easily linked to original arcade aesthetic.



Figure 4: The Commodore 64 version of *Operation Wolf*. The HUD is expanded to run underneath the play area in order to create space for readable and recognisable low-resolution versions of the arcade icons.

FORGOTTEN WORLDS (1989)

The *Forgotten Worlds* (Capcom, 1989) home conversions were produced by Arc Developments for uk based software house US Gold (South 1989, 23-26) *Forgotten Worlds* is a side scrolling shoot em up for simultaneous two player play, where the player characters main fly through space wearing rocket packs while wielding bazookas, fighting flying lizard aliens and giant dragons along their journey.

Arc developed all of the ports in parallel over a brief a four month timeframe, with their process facilitated in part through a PDS (Programmers Development System). This kit allowed development in assembly language on an IBM PC connected to the target Z80 and 6502 processor based platforms via a custom link cable. On the parallel development process, Arc team member Byron remarked “It works well, there's a lot of ideas going between machines. If you did it one version at a time you'd probably end up with one very good version... the first one. Then you'd get a bit bored, I think. It's better to get the job done in a few months and move on”.

Arc were not provided with any source files by Capcom, leading the team to manually replicated the arcade machine visually, sonically, and in terms of gameplay. The arcade PCB was accessible solely as a play only device, with the game code and assets contained on the ROMs inaccessible to the developers. The only direct manipulation of the arcade game hardware was the addition a pause switch through a hardware hack, which aided the development team in their task of studying gameplay patterns and on screen visuals.

A digital image capture setup was trained at the arcade monitor, using a video camera alongside Digiview Gold to capture the image for editing in Deluxe Paint. This image transference resulting in the arcade graphics undergoing an initial four levels of filtering before been converted across to each target platform. This pipeline starts with the scanlines, reflection, luminescence, and curvature applied to the image through it's display on the cathode ray tube screen of the arcade machine. The second filter layer is added through the optics of the video camera used, with the limited colour palette and resolution of the Digiview and Commodore Amiga capture setup

adding a third level of colouration to the image. The final filter level is added through the hand and eye of the artists tasked with taking the video captures and rotoscoping them into a consistent style.

The comparison image (figure 5) from a cutscene demonstrates the change in visual style between the arcade original and the edited video capture. The accompanying commentary offers subjective encouragement from the reviewer to both the development team and prospective purchasers of the then upcoming release that the graphics were an improvement on the arcade original.



Figure 5: A comparison between the arcade screen capture (left) and the retouched version on the Commodore Amiga (right).

Some graphics were redrawn from scratch because of a lack of satisfaction with the screen capture source (South 1989, p. 25). An example of this is the mid-level shop stage (figure 6), although the difference in resolution between the arcade original at 384 x 224 and the Atari ST port at 320 x 200 (figure 7) is relatively small, the ornate fine lines of the pixelated metalwork details of the screen did not survive the transfer process, due to the distortion of narrow details through lens capture and low resolution digitisation, necessitating a complete redraw of the scene.



Figure 6: The shop stage in the arcade version of *Forgotten Worlds* at 384 x 224 resolution.

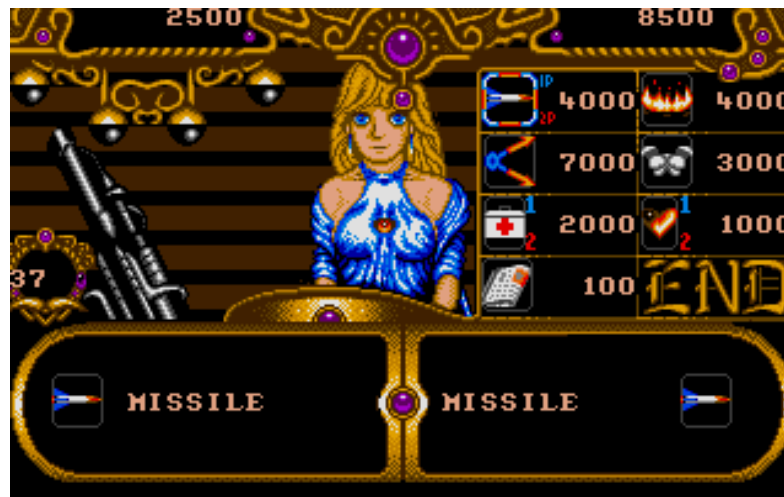


Figure 7: The 320 x 200 pixel resolution Atari ST rendition of the *Forgotten Worlds* shop stage.

The redrawn graphics were limited an eight colour palette, with a stippling effect used to increase the perceived colour depth where necessary, a technique that uses the refresh blur of CRT screens to optically blend duotone single pixel grids into a perceived third colour, with varying stippling patterns used to create multiple textures. All the reworked images were saved as Amiga IFF files format (International File Format, a standard devised by Commodore and Electronic Arts), and then converted to multiple systems using Arc’s own custom software solution.

“The graphics have been sourced on an Amiga 500 and then ported to the destination machines. “The is one of the new things we’ve tackled with *Forgotten Worlds*” says Paul, “new ways of porting ten special converter routines to take the work out of converting Amiga IFF files to Spectrum, PC, ST, C64 and Amstrad formats, so with luck Paul only has to draw the graphics once” (Penn 1989, 24).

The porting process for all music and sound effects follows a similar analog transferral process, with the arcade game audio recorded on cassette and then transcribed and re recorded for each target platform "It's a case of sticking a microphone in front of the machine and recording what comes out" (ibid, p.26).

RAINBOW ISLANDS (1989)

Graftgold's port conversion process for Taito's *Rainbow Islands* combined both direct reference of the arcade machine and the use of original media supplied by Taito in the form of image files in IFF format on PC formatted 3.5" floppy disks (figure 8). The Atari ST could read PC disks, but couldn't read the IFF file format. This instance is illustrative of the lack of interoperability between home computing platforms in the 1980s and early 1990s. The development team programmed a custom utility in STOS to convert the IFF files to Atari ST Neochrome graphics format (Figure 8). The images supplied included images that did not make it into the final game release.

"The graphics provided probably came from the designer, as some sprites simply weren't present and so had to be drawn from scratch. There were also some extra frames of animation, such as Bub 'surfing' over the rainbows instead of merely walking. More amusing though, is a sequence where Bub takes all his clothes off and changes into a Superman outfit" (Penn, 1989, 16).

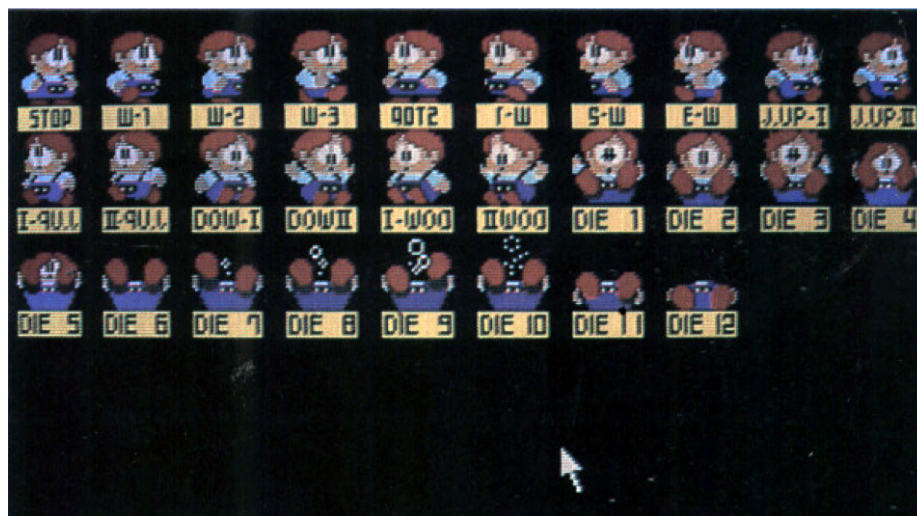


Figure 8: *Rainbow Islands* character animation frames.

According to Penn's interview, approximately 50% of the game's graphics were hand rendered using photographs and a video recording as reference material.

Communication and language barriers between the arcade developers and the conversion team were also an issue, with the game's music supplied in sheet music form with Japanese notation. With no access to a translator, the Graftgold team resorted to transcribing the music directly from the arcade machine.

Transferral of the gameplay mechanics and level structure to the home computer ports was made possible through extensive note taking of gameplay interactions and level maps. Team member David O'Connor asserts that his direct experience of the gameplay was a necessary addition to the provided paper based documentation:

"We have to sit down and analyse the way creatures move and so on and try to recreate this. Taito provided a large booklet with the original game design rather than programming notes, so although we know who fires what and at what speed things move, most of the information isn't that relevant to the arcade game as we know it." (ibid).

The Atari ST (figure 9) was the original 16-bit computer port of Rainbow Islands, with the Commodore Amiga version been a port of the ST port. The lesser powered Atari ST was used as the development machine for both graphics compression and decompression. The read speed of the disk drives for both systems were an additional constraining factor alongside the audio visual capabilities of the Amiga versus the ST, and so the game was optimised on lesser equipped ST first.



Figure 9: The Atari ST port of Rainbow Islands.

Rainbow Islands on the 8-bit platforms is effectively a demake, however the cartoon graphics style did convert across relatively intact to the Commodore 64, Amstrad CPC / Schneider (figure 10) and ZX Spectrum versions. The C64 version is characterised by a muted colour palette, with the ZX port compensating in detail for what it lacks in colour dept. The Amstrad version strikes a balance between the aforementioned two platforms, with graphics that are blockier than the Commodore 64, but capitalising on the saturated colour palette of the CPC.



Figure 10: *Rainbow Islands* for the Amstrad CPC / Schneider.

Both the 8-bit and 16-bit versions share the same adjustment to the gameplay control scheme, with each system using a default 1 button controller. The original arcade incarnation of Rainbow Island uses an 8 direction joystick alongside a jump button and a fire button. The home version use the solution of pressing up on the joystick to jump, which does not impede the gameplay and is an issue only for someone making the initial switch from the arcade version to the home computer port.

MIDNIGHT RESISTANCE (1990)

Liverpool based Special-FX produced the home conversions of Data East's *Midnight Resistance* for Ocean Software (1990). Special-FX used the arcade version of *Midnight Resistance* (figure 11) as their sole reference out of necessity, as the disks supplied to them by Data East containing the original graphics files became corrupted. The team used a video camera pointed at screen to record game footage to VHS tape, which was then referred to by the artist who redrew the graphics from scratch from this source (The One 1990, 52).



Figure 11: *Midnight Resistance* in its original arcade incarnation.

Midnight Resistance's Commodore Amiga port is the closest graphical approximation to the original, retaining its simultaneous 2 player mode and scrolling playfield (figure 12). The Atari ST has similar resolution but is limited to single player gameplay, and uses a flip screen system instead of scrolling.

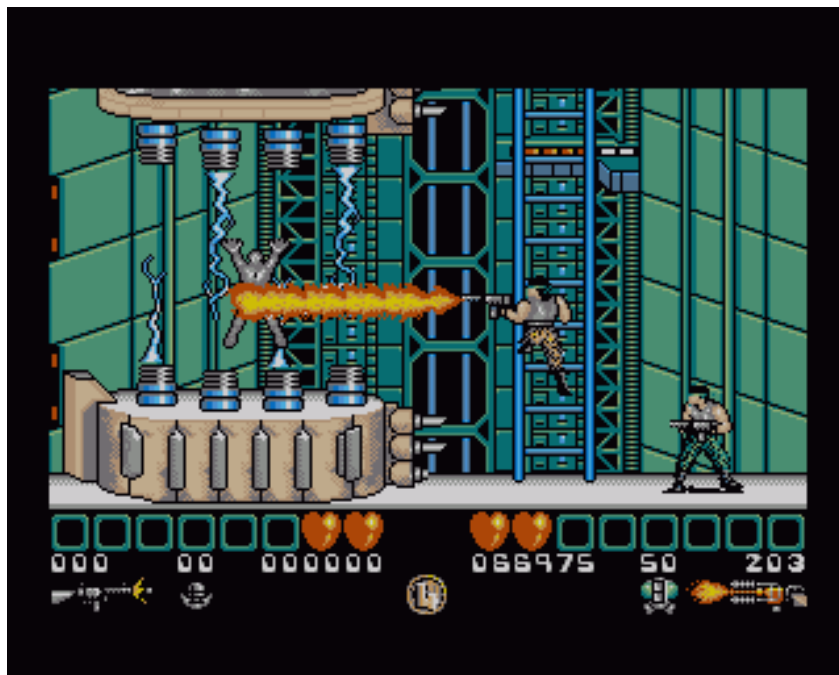


Figure 12: The Commodore Amiga Version of *Midnight Resistance*. Due to limited resources the HUD is no longer superimposed over the playfield.

The Commodore 64 conversion is recognisable but (naturally) rendered at a lower resolution to the 16-bit original, but it animates and scrolls smoothly (figure 13). However the ZX Spectrum (figure 14) and Amstrad CPC versions are particularly noteworthy due to their original reinterpretation of the game characters and environment in a style reminiscent of the Super Deformed / SD style technique used in Japanese comics and animation.



Figure 13: *Midnight Resistance* for the Commodore 64.



Figure 14: The super deformed cartoon style graphics of *Midnight Resistance* for the ZX Spectrum, using the limited graphics capabilities of the platform to the best effect.

By taking this decision to radically alter the games aesthetic, the ZX Spectrum and Amstrad versions of *Midnight Resistance* maximise the graphical constraints of their host platforms, rather than presenting watered down versions of the original.

The triumph of the Special-FX *Midnight Resistance* ZX Spectrum port is celebrated in a magazine advertisement (figure 15) placed in *The One* (1990), a multi format magazine with an emphasis on the 16-bit market. While the advert is for five main formats (with the DOS PC excluded), the 8-bit ZX Spectrum version is the focus of the promo, with the ‘Crash Smash’ reviewer accolade from the venerable ZX Spectrum magazine highlighted alongside the endorsement: “Graphics are very impressive... all sprites and backgrounds are beautifully detailed... more playable than its arcade partner. Brilliant!” (Crash 1990, 40).



Figure 15: The Spectrum-centric magazine advertisement for Ocean Software’s home ports of *Midnight Resistance*.

The dedicated *Midnight Resistance* coin-op cabinet uses a rotary joystick for each player, moving it in eight directions controls the characters movement, while rotating

the stick fires the weapon through in a circular arc. For example, the character can run forwards while shooting in an 360 degree rotating pattern. Just as with *Rainbow Islands*, the home version of *Midnight Resistance* simplifies the control scheme to work with a single button, eight direction joystick. To rotate the angle of fire the player must hold down fire and rotate, individual gunshots at a rapid fire pace to not affect the direction of movement. The one button control scheme is successful in translating the rotating fire gameplay mechanic to the home systems.

PORT AUGMENTATIONS

The home microcomputer port of Toaplan's *Snow Brothers* for the Commodore Amiga and Atari ST by Ocean Software France (1991) never saw a commercial release due to licensing difficulties (CodeTapper 2012). Following the trend established by the earlier arcade conversion workflows at Ocean for *Operation Wolf* and *Midnight Resistance*, Toaplan supplied the team with the coin-op original, who in turn performed an observation based transferral of the game assets and logic by directly referencing the arcade screen.

The developers used a combination of Amiga and Atari ST based custom tools to perform the 16-bit conversions, allowing optimisation of memory and storage resources: "specially written software which allowed them to animate the sprites within a very small amount of memory and also compact the screens. With the memory saved by these special techniques, the actual coding was made easier, and Pierre was allowed a pretty much free reign to incorporate nigh-on everything from the coin-op." (Merritt 1991, 28).

When compared to the assets from the arcade version, the sprite sheets closely resemble to the original, but have slight idiosyncracies, bearing the artistic flair of the conversion artist. *Snow Brothers* on the Amiga also features the addition of an original animated introduction that adds an extra narrative layer to the original game scenario (figure 16).



Figure 16: The Amiga and Atari ST exclusive *Snow Bros* intro animation.

The 16-bit ST and Amiga ports of Capcom's *Mercs* by Tiertex (U.S. Gold, 1991) was also carried out using just the arcade machine as reference, with developers Anthony Ball and David Bland adding their own modification to the original in the form of a clown nose weapon (figure 17) which while humorous was completely out of step with the tone of the game (Retro Fusion 2015, 166). A game tester spotted the rogue clown based weapon and requested its removal. In response Ball and Bland added a hidden level to the Amiga version called the Secret Garden, which contained the banned Clown Nose weapon, so undoing the hidden weapon ban. The *Mercs* programmers also rebelled against Tiertex company policy by hiding their names on the credits page, their details made accessible by pressing the star key on the numeric pad.



Figure 17: The Amiga version of *Mercs*, featuring the secret Clown's nose weapon.

CONCLUSION

The arcade to home microcomputer ports detailed in this paper demonstrate that while often the original arcade developers supplied source graphics on disk, in addition to paper based design documents and music notation, the conversion teams relied overwhelmingly on the original arcade machine as a reference when working on all areas including gameplay, audio, and visual aesthetics.

There are a number of factors that can be attributed to this 'go it alone' methodology employed by the conversion teams. In part it can be connected in part to the

communicative and geographic disjoint between the original arcade developers based in Japan and the conversion teams based in Europe. Without the benefit of Internet based instant communications and translations, and reliance on the transfer of digital media through the postal service, this difficulty in exchanging digital assets and design insights between both sides made it necessary for the conversion teams to be self-reliant in their production process.

An example of the platform divide between the eastern and western markets of the late 1980s and early 1990s is the Sharp X68000 (1987). An early multimedia powerhouse, the X68000 was used as the development machine for Capcom's CPS1 arcade titles, including *Street Fighter II: Champion Edition* and *Final Fight*. Both of these arcade titles were published as near-identical ports for the X68000 in the Japanese home market, albeit with the inclusion of floppy disk-based storage and loading times. This platform had a unique operating system and was not part of the western home computer ecosystem, providing an obstacle towards direct home conversions. Apart from the technical parity of the X68000 and CPS1 platforms, the X68000 versions of *SF2:CE* and *Final Fight* were produced in-house by Capcom, a far cry from the technical, logistical, and communicative distance experience by U.S. Gold's home port developers.

Another critical factor were the crunch-time schedules that the conversion teams operated under, for example the 4-month deadline in which the five different *Forgotten Worlds* home ports were produced by a team of 6 people. Considering this time constraint, it is understandable that the teams forged ahead on an independent and focused development schedule.

In all the instances discussed, even when original graphics files were made available, the original arcade machine was played, sketched from, recorded, and in one case hardware hacked through the addition of a pause button. Nonetheless, the code and audiovisual assets contained within the reference PCB remained inaccessible as a closed-off, black-box platform.

From the examples covered, none of the conversion teams were supplied with source code from the original arcade versions, necessitating writing all code from the ground up. The commercial PDS system used by Arc Developments streamlined the development process, allowing for use of a central PC-based system for machine code programming, which was then transferred to each of the target platforms. Each development team also used custom toolsets to build their products, for example to convert between graphics file formats, to enable porting content between each platform where appropriate. The Atari ST to Amiga workflow of Graftgold's *Rainbow Islands* 16-bit conversions constitutes a port of a port, with the baseline system taking dominance in the development cycle.

Apart from the most immediate platform constraints of visual resolution and audio playback capabilities, data storage, memory, and processing constraints also shaped the gameplay experience. The addition of load times between levels, and the subtraction of non-essential features such as extra animation frames, and layers of parallax scrolling on the backgrounds were necessary in order to preserve the core gameplay experience.

Cassette and floppy disk-based media can impose significant loading durations, often drastically altering the pace of the arcade experience. The 1992 port of Capcom's *Street Fighter 2* by U.S. Gold for the ZX Spectrum (figure 18) is an extreme example. The long and repeated loading times add an extra layer of tension to the game, testing the player's patience through a meta-game where the gamer must carefully

rewind or fast forward the cassette tape to the correct counter location in order to successfully load the next stage.



Figure 18: The ZX Spectrum cassette loader version of Street Fighter 2: The World Warrior.

The ZX Spectrum home conversion of Data East's *Midnight Resistance* demonstrates that a port to a less technically advanced platform can result in an experience that is faithful to the original and extends it into a new direction. By exercising artistic license and understanding how to best harness the aesthetic constraints of the target platform alongside an adeptly adapted control scheme, the original gameplay feel can remain and compensate for a lack of pixel perfect visual accuracy.

Similarly the easter eggs added by the *Mercs* conversion team and the extra cutscene graphics included in the Amiga version of *Snow Brothers* demonstrate the room for creativity by expansion of the gameplay flow and narrative by the conversion teams. Even where no extra features are added to the game, the analog filter of human machine art interface leaves subtle and indelible imprints of the team's own individual process aesthetic on each home port, illustrating that the arcade to home computer ports of the late 1980s and early 1990s often went beyond duplication, becoming adaptations carrying the unique creative signatures of their translators.

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