Nintendo Emulators

Simon Goodwin is your guide to the burgeoning range of emulators that run Nintendo Entertainment System cartridges on your Amiga.

AFCD20:-In_the_Mag-/Emulators

ON THIS MONTH'S CD

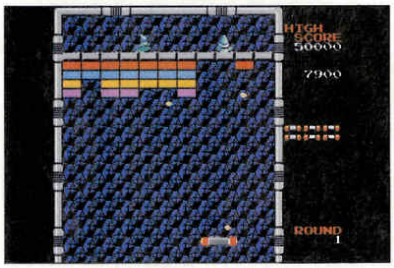
ON THE COVER CD

There are four NES emulators on the AF Cover CD, plus workbench-friendly launchers, Nintendo system documentation and tools for examining cartridge files and 6502 machine code. Nintendo ROMs are copyright and are not included, but plentiful on the Internet.

NES Emulators at a glance

	ANES	AmiNES	CoolNES	DarkNES
VERSION	0.28b	0.1b	0.39b	0.13
NATION	Sweden	Spain	Sweden	Canada
DOCUMENTATION	15K Guide	1K Text	8K Guide	5K Text
LANGUAGE	Asm	Asm	Asm	C
CODE SIZE	14K	18K	16K	36K
SOUND	No	No	Yes	No
HARDWARE	AGA,020+	AGA,020+	AGA,020+	020+
CONTROLS	Key/1JS Key/Pad/JS Yes	Key/2JS Yes	Key/2JS Ish	GUI No
GAME SAVE	Yes	No	Yes	Yes
MULTITASKING	No	No	No	Yes
PRICE	Free	Free	£12	Free

The Nintendo Emulation System, or NES, was the first successful games console from the Far East. Introduced, in Japan at least, a year before the Amiga, the NES capitalised on the slump in US video game sales in the mid-1980s, stepped into the gap, and sold millions all over the world.



***Galaga*, Namco's Space Invaders with knobs on.**

***Arkanoid* – Taito bring Nolan Bushnell's *Breakout* into the '80s.**

> *A year ago there were no NES emulators on Aminet, now there are four and new versions appear weekly.*

Nintendo moved into video games in the 1970s, programming classics like *Donkey Kong* for Atari coin-op hardware. The NES is little more advanced than the Atari consoles it usurped, with exactly the same aim – to pack lots of graphics and gameplay into small ROM cartridges, and sell each title for a large sum. Priced for impulse buys, with classic games like *Mario Brothers*, and a lucrative royalty to Nintendo on every game sold, the NES was a marketing phenomenon. By 1992 it had sold 30 million units in the USA alone.

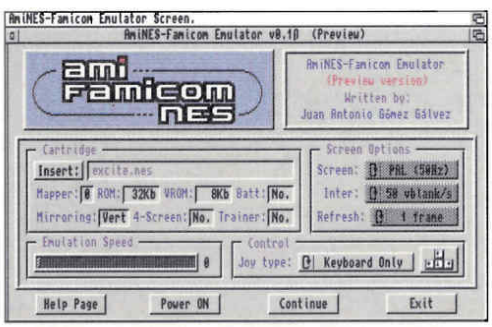
PLAYABILITY

Despite the Japanese reputation for unoriginality, and simple graphics, the games on the NES are first rate. Firms like Namco (*Pacman, Galaxian, DigDug*), Konami (*Castlevania, Ninja Turtles*), Taito (*Space Invaders, Arcanoid*) and Nintendo themselves might lack expertise in strategy and simulations, but the playability of their titles, honed in the arcades, is exceptional. For all the strengths of the Amiga, Nintendo emulation is not to be sniffed at. A year ago there were no NES emulators on Aminet, now there are four and new versions appear weekly.

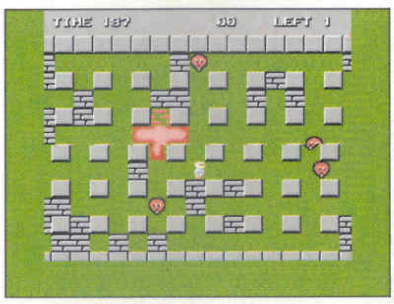
A/NES and *CoolNES* hail from Sweden; *DarkNESs* is the Canadian entry and the newest arrival, *AmiNES* comes from Barcelona. Unix devotees may choose *iNES*, from Marat Fayzullin. Marat has influenced all the Amiga NES emulators through his PD Unix code and technical documentation.

CHALLENGE

NES emulation is tough, even on a 32-bit Amiga, because there's a serious lack of documentation. Nintendo taxed



***AmiNES* has the best GUI of Amiga NES emulators.**



***BomberMan* suffers a bit without sound.**

HOME PAGES

Amiga Emulators:
http://www.pncl.co.uk/~martinc/emulators/
A/NES:
http://home2.swipnet.se/~w-28134/ANES/
CoolNESs:
http://hem2.passagen.se/flubba/
Marat Fayzullin:
http://www.freeflight.com/fms/

evelopers heavily for the privilege of riting for the NES, vetted their oftware and tried to keep the works a ecret. This had the desired result of eeping software prices – and, in eneral, quality – high, but it makes mulation challenging.

The minimal console hardware, and elatively high software prices, ncouraged Nintendo to put extra ardware in the cartridges. They ugmented the main game ROM with xtra RAM – including permanent iemory for high scores and game ositions – and circuits to improve raphics and game timing.

MAPPING

he original limit of 32 kilobytes per rogram – generously described as 256k in bits!) by Nintendo – was soon a estriction and hardware was extended o allow more memory, by 'mapping' it iecemeal into the 8-bit processor's pace. Emulators must mimic not only ie console but also the 'mapper' in ach cartridge. This has been the main rea of refinement since the first Amiga ES emulators arrived.

Mappers may contain code or raphics in ROM, VRAM for video nages, or non-volatile RAM for saved ames. A utility on *AFCD20* extracts the apper number and other details from .NES ROM image file.

Low numbers are the most ommon. 0 is the simplest, a single-page OM. *Zelda* uses Mapper 1 to control its 28k. Most Konami games use mapper , which gives one fixed and one vitchable 16k page. Mapper 3 uses a xed program and switchable graphics ages, mapper four allows scan-line terrupts, and so on. The mapper pport table shows the claimed ompatibility of emulators and mappers.

GRAPHICS

he NES display background is built up om 1024 tiles, each eight by eight ixels wide. Attribute graphics allow 16 olours, represented by four bits. Two its are stored in each tile, and the other o come from attributes which select our from sixteen colours, in 32x32 ixel blocks.

The whole screen is encoded in just 024 bytes for the tile numbers, and 64 tribute bytes. Each tile pattern needs 6 bytes, but tiles can be re-used and re-oloured without taking any more emory. Large scale animation is possible by changing tile patterns during vertical blanking of the display.

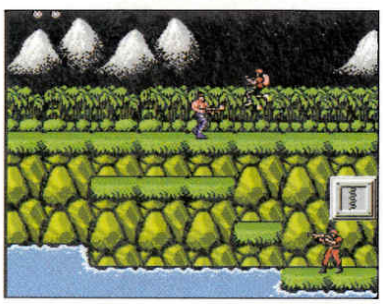
***Centipede* in a Unix X-window.**

Thus a big map can be stored in a relatively small ROM. It's a kind of hardware graphics compression that's tough to emulate, even with the Amiga's custom chip assistance. Vertical and horizontal scrolling depends in part on the cartridge, rather than just the console hardware. Emulator switches toggle 'vertical and horizontal mirroring' if the default gives a scrambled screen.

The background image in memory is 256 pixels square, trimmed vertically to 240 pixels for European displays and 224 for the US and Japan. Amiga displays with 224 lines require PAL mode, or NTSC overscan, which upsets a few US displays. The image occupies about three quarters the width of a PAL overscan display.

> *Typical NES games use repetitive backgrounds... with player characters and powerups superimposed.*

Scrolling NES shoot-em-up *Argus*.



***Contra* is a good test of horizontal scrolling.**

Typical NES games use repetitive backgrounds like platforms, with player characters and powerups superimposed. Sprites are overlaid on the background and use the same tiling scheme, except sprite tiles can be twice as tall – up to eight sprites can appear on each line.

Sprites and background have separate palettes so most emulators simplify processing, at the expense of graphics speed, by using a custom eight-plane AGA display.

***Defender 2*, another very playable NES cartridge.**

The NES has five audio channels including PCM for short samples, one for 'noise', and three for periodic pulse or triangle waveforms. These are relatively hard to emulate because the NES can vary the pitch of the waves, as well as the volume, dynamically as notes are played. This does not mesh well with the Amiga's approach, based on playing samples at adjustable – but generally steady – rates.

A/NES

A/NES is a team effort from Morgan Johansson and Fredrik Schultz. A simple GUI uses the supplied Nintendo fonts, though the task and AmigaGuide lack Workbench icons. You get a 6502 register display, and can save game positions and preferences.

A/NES requires AGA, but a slower ECS version is promised, along with Action Replay emulation. Speed varies with the amount of activity on the screen, as delta buffering is used to optimise updates. Overall it's pretty fast, and runs simpler games nicely, but there are sometimes conspicuous bugs in its background handling. Sound is not supported, and described as 'low priority' – which seems a pity.

AMINES

I beta-tested *AmiNES* and the first release, version 0.1, recently reached Aminet. As the name suggests, *AmiNES* is a sibling of *AmiGameBoy* and *AmiMasterGear* from the prolific Juan Gomez. It has the familar neat GUI, with support for keyboard, CD^{32} gamepads or joysticks with one or two buttons, but few other frills.

Sprites hop eight pixels at a time and are not masked so they appear on a box on top of the background. There's no sound and horizontal mirroring of sprites is ignored. *Millipede* and *Arkanoid* run well, if a little unevenly. *Pinball* was playable despite the sliced appearance of the right flipper.

Balloon Flight and *Nintendo Tennis* show similar cosmetic problems. *Popeye & Donkey Kong* sprites appeared corrupt when they were moving from right to

Continued overleaf ➡

CARTRIDGE MAPPER SUPPORT

	AMINES	ANES	COOLNESS	DARKNESS
0	100%	100%	100%	100%
1	No	Some	Some	90%
2	Some	100%	Some	100%
3	No	100%	100%	100%
4	No	Some	No	70%
7	No	Some	100%	40%
9	No	100%	100%	Maybe
11	No	No	No	80%

← left, and the sprites in *MsPacMan* wander all over the place, making the game pointless.

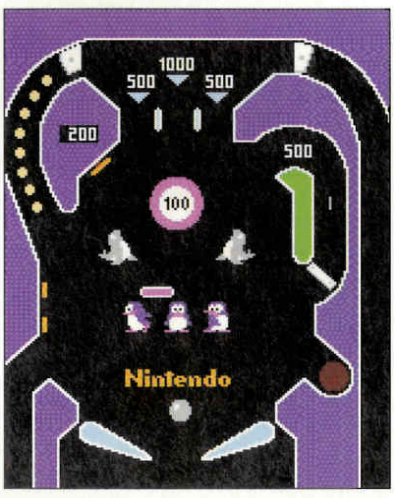
Several games were completely unplayable. The sprites in *Contra* were only half-visible. *BomberMan*, *Defender II* and *Excite Bike* all got stuck at the start, and *Galaga* threw up a despairing "La pila se ha ido a la mierda!" requestor! *Zelda* and *Bump'n'Jump* required mappers which are not yet supported. *AmiNES* is fast, when it works, but as yet it's the least compatible. With MSX, Game Boy and Sega emulators already out, perhaps Juan has eyes bigger than his stomach, but he's making progress.

COOLNESS

CoolNESs is the second contender from Sweden, from lone hacker Fredrik Olsson. It outpaces *A/NES* and has impressively fast and smooth scrolling but, like *AmiNES*, sprites jump in eight pixel steps, rather than glide smoothly across the screen. This is the only emulator supplied 'crippled' on Aminet – unless you send £12 to register there's a time limit. Registering also gets you sound support which makes the games much more fun to play. Support for two button joysticks also helps. *CoolNESs* starts from a Workbench icon, and displays a file requestor in the current directory before opening its own custom PAL screen. You must restart for each game. *CyberSnooper* caught some non-68060 instructions which my Cyberstorm had to emulate.

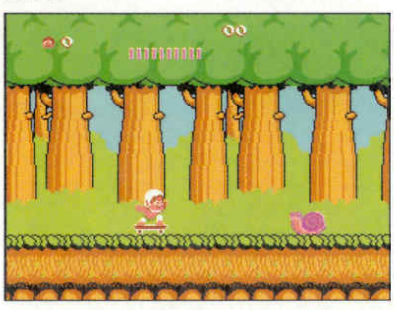
The *Defender II* background scrolls well but the foreground moves jerkily with some sprite glitches. The radar frame scrolled when it should not, but the radar points stayed in the right place, so the game was still playable. Sprite problems also affected *Zelda* and *Adventure Island*, though not enough to prevent play.

Frederik plans to fix the sprites, adding support for mapper 1 and ECS graphics. The sound needs more work, but it is a unique selling point.



TV display width is a challenge for Pinball simulations.

Giant snails and skateboards in the bizarre *Adventure Island*.



DARKNESS

DarkNESs is Mark Van Hal's Amiga port of *iNES* from Unix. It's compiled with GCC and again uses 64-bit instructions the 68060 must interpret, including some which cast serious doubt on the Gnu C optimiser!

Mark plans a hand-coded version – version 0.13 is a bit sluggish even with a Cyberstorm 68060. Performance on a 32MHz Warp Engine 68040 is unbearably slow unless the display update rate is dramatically reduced.

On the bright side, *DarkNESs* does not require AGA, unlike the others. It works with PicassoII RTG, looking great in 320x240 mode, but updates are slower than with AGA. The reduced requirement for display planes boosts AGA and hampers the graphics card. It's still impressive that it works, and a good sign for future compatibility. *QuickGrab* had no trouble snaffling pictures for this article from its ECS, AGA and RTG displays. So far *DarkNESs* has no GUI although simple add-on ones are on Aminet.

Arkanoid is smooth but sluggish when played at 25 FPS, claiming 41 per cent speed on a 50MHz Cyberstorm. A Warp Engine 68040 with Picasso 2+ managed 18 per cent and 11 FPS, rising to 31 per cent and a reasonable 19 FPS in PAL mode; slightly less in DBLPAL Lo-Res with Mode Promotion. A faster graphics card might reverse the gap, but this is a CPU-intensive emulator.

Display updates were noticeably jerky, especially when scrolling, but many games were playable with a bit of tuning. *Defender II* was particularly good fun, but perhaps I'm too old for the real thing, these days! The lack of sound though, does make it a little hard to tell what's going on during pauses in the action.

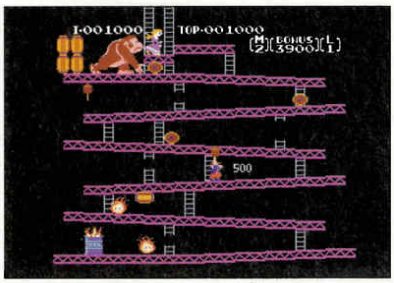
After extensive tests, Mark reckons that 102 games work fine, 15 are glitchy, and 13 fail, out of the 130 he's tried. My experience bore this out – particularly in its sprite handling, *DarkNESs* shows fewer flaws than its rivals. You may need to press a key to toggle mirroring if the preset .NES file header misrepresents the expected graphics organisation. *DarkNESs* works this out automatically for mappers one and four so it's rarely an issue.

DarkNESs is system friendly and the best choice for Power Amiga or 68060 users – it's too slow for lesser beings.

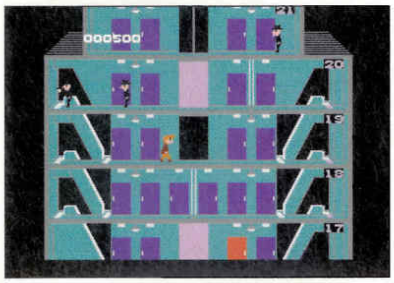
COMPARISONS

CoolNESs has the great advantage of sound, once registered. *AmiNES* is fast but poor sprite and mapper handing means it cannot yet be recommended.

A/NES shows promise but weird background effects make some games unplayable. *DarkNESs* is the most compatible, though still not perfect, and by far the slowest. It's probably easier to speed up a correct program than to fix a fast one, so *DarkNESs* may be the one to watch. If you can run Linux 68k or NetBSD, Marat's *iNES* deserves consideration. *iNES* is slow but accurate, with good sound. NES emulation is fast-advancing, and all these emulators are likely to develop over the coming months.



Nintendo mascot *Mario*'s first outing



***Elevator Action* gives your emulator a lift.**

The NES incarnation of *Joust*.

MEANWHILE...

...new emulators roll in, several older ones await scrutiny, and AF102's data emulation feature needs a follow-up to discuss data formats and conversion tools.