The Future was 16-Bit

Creating a Comic Book on 1980s Hardware

Pixel Art Comic Project Documentation

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The Purpose and Objective of this Project

There is a notion that new technology is *always* better than old technology.

The longer the time period, the better. But is this really always true? Over long time periods, we seem to believe that it is irrevocably true. I doubt that anyone will contradict me when I state that thirty-year-old computer hardware is worse than modern day hardware. The processing performance is far worse, the memory is significantly smaller, its storage media of diskettes, spinning hard disks are archaic by comparison, and the input methods are clunky and inelegant.

But old computers were not useless at the time. They enabled users of the day to produce text documents, spreadsheets, graphics and, yes, even artwork.

And they still do.

Objective of this Project

This project is part of the Media Arts Histories program of the Danube University Krems. The objective is to refurbish a thirty-year-old Atari computer, upgrade it and then - well within the technical constraints of the day - to use it to create a five-page comic.

In this project, I want to prove that thirty-year-old hardware might well be far less capable than modern day hardware, but that it is not totally useless. I used an Atari Mega STE with a few expansions to enable the data exchange with modern computers, to be able to use a modern-day monitor and to record the actual process using a video capture device. And then I proceeded to paint a comic story on it in the pixel art style.

The project took roughly six weeks, occasionally with project days of up to 12 hours. I purchased the old hardware and refurbished it. I upgraded it with the necessary modern-day components. I researched and downloaded the necessary software, then I started creating the comic by sketching out the story, drawing the characters using pencil, pen, and paper. After scanning the designs, I laid out the individual elements across panels and pages, after which I pixelpainted the images in color, using established work methods like shading, dithering, and anti-aliasing.

Finally, I lettered the dialog and captions into the panels and combined them into full pages. The final pixel art comic, which is the result of this project, can be seen in chapter **VII. The Future was 16-Bit**.

Is it an Art Project?

I am not an artist. At most I can admit to being a designer, and a mediocre one at that. The purpose of this project is not to discuss whether comics are a form of art, or whether the aesthetics of pixel art constitute a valuable addition to media arts history.

Both comics and pixel art have good and bad works. Discussing whether each medium can be considered art, is like discussing whether any written word can be considered literature.

For the purposes of this document, I will refer to the graphics produced as "artwork." I hope that this wording is neutral enough.

Why Pixel Art?

The mid-1980s were a time of transition for home computer graphics. On the 16-bit machines of the time, including the Atari ST, the Commodore Amiga, and the Apple Macintosh, the graphics capabilities were too limited to allow for much more than pixel art. They essentially used paint programs to directly draw the pixels on the screen. The software did offer fill tools and pattern tools, but the graphics did not allow for more than a pixel to be drawn at precision. Now, decades later, an image file in a graphics application can hold much more information than can be displayed on the screen. Not only are the pixels of modern day displays nearly imperceptibly small, the image might be shown at a magnification where not even all of the available information is displayed.

Yet even in the early days of home computer graphics, the potential was becoming apparent. The reason why the 16-bit machines were at a transitional stage was because the computational power and memory to do more with the images than simply have a pixel on screen represent a pixel in memory. Particularly on the Apple Macintosh, the first applications enabled users to draw in vector graphics. These were composed of coordinates and color fill information, so they could be zoomed and displayed at any size without losing their crispness like pixel graphics.

Yet, due to the limitations of the day, pixel graphics were the predominant method to create and share graphics. Back then, this was out of necessity. This led to the familiar “video game” aesthetic. Today, with the vastly more powerful graphics hardware that allows for photo quality images, this aesthetic is by choice and no longer by necessity. Artists *choose* to produce pixel art on modern hardware.

Pixel art is interesting because it was limited back in the day, and it can also be limited by *choice* today. Some of the most creative work can be done with clear and well-defined limitations. Given only 16 colors and an overall palette of 512 possible shades, you can only try to go as far as these limitations will take you in your effort to accomplish what you want.

As Mark Ferrari from Terrible Toybox describes it in his talk at the Games Developers Conference (GDC) in 2016: this creates an environment that is small enough to be creative in, where artists can maintain full control over all aspects. They do not have a giant ineffable cloud of possibilities that can pull them in any and every direction. Low resolution pixel art with a limited color palette is a mentally and creatively manageable space to work in (find his video at https://youtu.be/aMcJ1Jvtef0)

It may seem counter-intuitive, but constraints can have a liberating effect on creativity. Once you have the ground rules out of the way, everything else is up to the creative artist. Just like writers choose to write poems or short stories within strict formal limitations or length constraints to focus on a specific message, emotional response or aesthetic, visual artists can choose to limit the resolution of their images and the available colors to deliberately produce a desired aesthetic.

The goal of this project it to make the distinct aesthetic choice to create a full comic story as pixel art. Furthermore, the project’s objective is to do this using the actual hardware of the day.

The Purpose of this Document

This document chronicles the process of creating the comic. I have recorded everything from the very first scribble right and hardware upgrade, all the way to the character and background designs and the final pixeling of the finished panels.

This document not only describes the process, but also provides the finished comic pages. It is a companion piece to the video documentation in three Youtube videos. Together with the text of this document, the videos can be found at http://marincomics.com/duk-pixelart/

Join me on my journey across time and pixels to produce a pixel art comic on a magnificently underpowered device from more than thirty years ago.

II. Journey Beneath the Metal

Assembling the Equipment

The first thing I wanted to get up and running was the actual hardware. I wanted to use a 16-bit computer from the 1980s. While 8-bit computers like the Commodore 64 and the Sinclair ZX Spectrum dominated the first half of the 80s, the most common platforms in the latter half were the Apple Macintosh, the Commodore Amiga, the Atari ST, and most widely used the IBM PC and its "clones." The Apple Macintosh of the time was a black-and-white machine with a small screen. I did not want to go down that path. The Commodore Amiga was a powerful graphics machine with capabilities well ahead of its time. This did not provide the limitations I was seeking. An IBM PC running MS-DOS using the extremely limited EGA graphics was much too limited, so I was left with the Atari ST range of computers.

The original Atari ST was introduced in 1985. It was a 16-bit computer with a Motorola 68000 processor (a.k.a. Central Processing Unit or CPU). Atari built this machine to compete with the Apple Macintosh and the Commodore Amiga. It was priced well below the competition and offered a blend of both of its competitors' capabilities without fully exceeding any of them. Atari iterated on the basic technology of the ST from 1985 to 1991. After a number of successors that were not as successful as the Atari TT and the Atari Falcon, the company folded in the late 1990s.

Figure 1: The Atari 1040ST, the first revision of the original Atari ST

(Source: Wikipedia https://upload.wikimedia.org/wikipedia/commons/3/39/Atari_1040STf.jpg)

Choosing the System

This specific model is the **Atari Mega STE** which was introduced in 1991. It is largely based on the original Atari 520ST from 1985 with some minor improvements like a processor running at twice the clock speed (16MHz up from 8MHz), an extended color palette and a sound chip capable of digital Pulse Code Modulation (PCM) for higher quality sound samples. The regular Atari ST has a keyboard case, i.e. the whole computer is in the keyboard. The Mega STE had a more professional look, with the keyboard being separate from the system unit, much like IBM PCs at the time, but with a sleeker design.

Figure 2: The Atari Mega STE

(Source: https://archiwum.allegro.pl/oferta/atari-mega-ste-i7309896659.html)

The case of the system unit has a built-in 3.5" disk drive and a fan. This adds annoying background noise during operation, but the fan makes the computer usable over extended periods of time by preventing it from overheating. The case also has room for a hard disk that is attached through the internal SCSI bus.

I purchased my Mega STE from the retro computer retailer Atari Fachmarkt in Germany for around €300. I decided to use a retailer instead of eBay because I needed a machine that worked reliably and had been serviced professionally. The device was in a great working condition. The retailer had cleaned it and replaced the electrolytic capacitors that are prone to leakage after decades of use. The Atari no longer had the original keyboard but had a replacement unit from a previous line called the Mega ST (without the "E"). The machine was expanded to its maximum of 4MB RAM and had the original spinning hard disk with 20MB in it.

Wishlist of Extended Capabilities

So now that I had the computer, I wanted to extend its capabilities. First of all, I wanted to be able to use a modern LCD. While I did still own a CRT (Cathode Ray Tube) screen, the model I had could not cope with the 14.6KHz horizontal sync signal from the Atari. More importantly, using a CRT at these low frequencies (50/60Hz vertical refresh) for extended periods of time is not something I wanted to endure. I wanted to use the Atari STE to a much more eye-friendly LCD screen. I not only needed the right cable, but also a way to up-convert the low horizontal sync signal to be accepted by modern day displays.

The next hardware feature I wanted to change was the 3.5" disk drive. The drive the machine came with was the original double density (DD) 720KB version. They do have an MS-DOS compatible disk format, but they are unreliable when writing to the more commonly available high density (HD) floppy disks that were designed to hold 1.44MB. I decided to completely do away with the disk drive and replace it with a storage medium that I could use with my MacBook Pro. I wanted to be able to exchange files between the Atari and my modern working machine.

The built-in hard disk was slow and unreliable. I doubt that I will ever make full use of its 20MB storage, but I also did not want to be limited by the small storage space if I ever did. So, I decided the hard disk had to go.

The last three extensions I wanted to make was to use a modern-day mouse instead of the original Atari ST mouse that had a rolling ball with pins tracking it. These mice did not endure the decades well and are practically unusable today unless they were kept in the most pristine condition. I wanted to replace the mouse with a more modern one. Perhaps, I might not even use the mouse to draw on the Atari, but rather, use a graphics tablet. The first good consumer models started to become widely available at the time of the Atari's release. And finally, I wanted to try networking the Atari Mega STE to my MacBook Pro for a more efficient mode of data exchange.

Making the Screen Upgrade

Finding the right cable to attach the unit to a more modern TV was not as difficult as I had imagined. At the time of the Atari's release the then new SCART TV port had been introduced. In essence, this was a composite video output in more or less square port design. This standard was introduced in France in 1976 and it used a 21-pin connector. Also, the port design was starting to be generally adopted by European TV manufacturers in Western Europe as of 1987. There was a large aftermarket supply of Atari RGB to SCART cables. I purchased a working cable reasonably on eBay. (More about the SCART standard here: http://fr.meric.free.fr/Articles/articlesba/stsurtvplat/Scart/BS_EN_50049-1%20Peritelevision%20connector.pdf)

The LG LCD display that I wanted to use with the Atari STE still had a SCART port on the back. The issue was again the wildly outdated 14.6KHz horizontal sync signal provided by the Atari. Even when connected to the LG LCD display, the screen remained blank because the signal was too weak. I researched a solution and it quickly became apparent that I needed a video scaler.

According to Wikipedia "a video scaler or upscaler is a system which converts video signals from one display resolution to another; typically, scalers are used to convert a signal from a lower resolution (such as 480p standard definition) to a higher resolution (such as 1080i high definition), a process known as "upconversion" or "upscaling" …So much for Wikipedia.

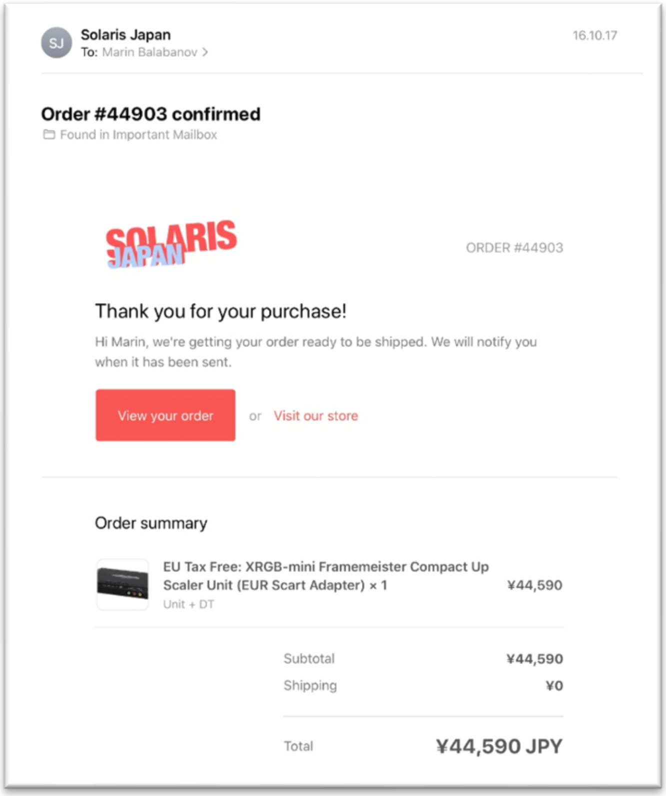
According to the no more unreliable retro computing forums on the web, there are dozens of cheap video scalers, but there was only one true HDMI upscaler worth using: the legendary **Micomsoft Framemeister** from Japan. This device had gained popularity in the retro gaming scene over the past decades. Particularly gamers who wanted to use their Nintendo Famicom video game systems and their Sega Megadrives from the 1980s swore by the Framemeister. The device takes the original low fidelity signal from the old hardware, runs it through a signal processor and upconverts it to an HD signal and outputs it to the standard HDMI port that can be used with most modern-day LCD or OLED HD TV and monitor. And the Framemeister does the work with a minimal processing lag.

Figure 3: Micomsoft XRGB mini Framemeister HDMI Scaler

(Source: https://www.eurogamer.de/articles/2015-08-20-micomsoft-xrgb-mini-framemeister-hdmi-scaler-test)

I knew that I had to get a Framemeister. Unfortunately, after a decade of production and a number of revisions, the manufacturer had ceased production of this dedicated piece of specialty hardware. The prices on eBay had skyrocketed. But I did not want to be deterred by banal setbacks as ridiculous prices, so with tears in my eyes I shelled out close to €360 to purchase and import a Micomsorft xRGB Framemeister Mini from Japan.

Weeks later the Framemeister arrived. This HDMI upscaler had a large assortment of ports, but to my dismay no SCART port. This should have come as no surprise, as the strictly European SCART port would be of a low priority in a device manufactured for the Japanese market where the small, roundly S-Video port had found a much wider adoption instead. I bought a converter from SCART to S-Video from a local chain of electronics retailers and could finally attach the Atari MEGA STE to the LG LCD display. The very low-fi signal from the Atari was converted and up scaled to a full HD display. Now, obviously the resolution here is still the Atari's original low resolution of 320 x 200 but it can be displayed in full quality on an HD screen. The picture on the LCD screen was beautifully crisp with consistent colors. The Framemeister was definitely worth it.


SJ Solaris Japan
To: Marin Balabanov >
16.10.17

Order #44903 confirmed
Found in Important Mailbox

SOLARIS JAPAN
ORDER #44903

Thank you for your purchase!

Hi Marin, we're getting your order ready to be shipped. We will notify you when it has been sent.

View your order or Visit our store

Order summary

EU Tax Free: XRGB-mini Framemeister Compact Up Scaler Unit (EUR Scart Adapter) × 1 Unit + DT	¥44,590
Subtotal	¥44,590
Shipping	¥0
Total	¥44,590 JPY

Figure 4: The painful invoice for the Framemeister order from Solaris in Japan.
Yes, the amount is approx. €380 with shipping (Source: Marin Balabanov)

New Floppy Disk Storage

The second extension that I've added is a replacement for the broken 3.5" floppy drive. This is an **HxC floppy drive emulator**. It is pin compatible to the old floppy drives from the day and replaces the floppy with an SD card. The reason why it is called a floppy emulator is because it pretends to be a regular floppy disk drive.

The card cannot be read as it would on a modern machine, but rather, it contains floppy images, i.e. exact captures of full floppy disks stored as individual files on the SD card. These captures of the floppy's content, these floppy images, are treated just like normal floppy disks by the host computer in this case the Atari ST. An SD card can hold thousands of images. Each individual image still only holds around 720KB, but effectively, the SD HxC is capable of providing thousands of diskettes to choose from when the machine boots up.

I purchased this from lotarek.pl, a retro computing enthusiast site in Poland.

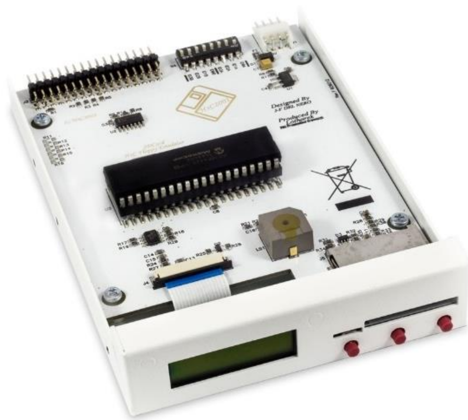


Figure 5: The HxC Floppy Disk Emulator

(Source: https://lotharek.pl/productdetail.php?id=28)

Hard Disk Replacement

I decided to replace the unreliable hard disk with a so-called UltraSatan. This device houses two SD cards and provides a standard SATA hard disk interface and a converter to the SCSI interface needed in the Atari Mega STE. The name is derived from the SATA interface and is not related to satanism, but rather to the hobbyist scene's sense of "cool."

The UltraSatan uses the SD cards as virtual hard drives, so the computer "sees" them as hard disk partitions. The Atari STE being created to legacy specifications cannot handle the massive SD card storage available nowadays. Even comparatively "tiny" SD cards with "only" 2GB are too large for the computer to recognize them as a whole. There is a solution to that: I partitioned each SD card into multiple partitions that are no larger than 512MB. So, I ended up with eight partitions in total over the two SD cards (with 2GB each).

The **UltraSatan** is simply attached to the Atari's external hard disk port as an external device or to the internal SCSI/ACSI port as an internal device with an appropriate SCSI terminator. I decided to use the external option because I did not have the needed SCSI terminator and I also thought it might be useful to be able to access the SD cards easily without opening the case.

This device was also available at the lotharek.pl retro hardware online shop. I purchased it for around 90 Euros and added a couple of low-capacity SD cards to it.

I copied a large assortment of applications, games, and demos onto the SD cards. Among them were graphics programs such as DEGAS, Cyber Studio CAD 3D, Cyberpaint NEOChrome, Deluxe Paint, and many others.

Figure 6: The cased version of the UltraSatan
(Source: https://lotharek.pl/productdetail.php?id=48)

Input Galore

To replace the mouse with a more modern mouse, I used a converter from PS/2 to 9-pin D-connector. The 9-pin D-connector is the Atari standard joystick interface that was also used for the mouse. The PC-standard PS/2 port was introduced by IBM with its PS/2 line of computers in the late 1980s. Before the wide adoption of the USB port, the PS/2 port became a de facto standard for keyboards and mice on MS-DOS/Windows machines. The **PS/2 Converter** enables a much more modern PS/2 optical mouse to be attached to the Atari. The PS/2 connector is not exactly the most modern interface because that connector started to deprecate around 2004/2005, but I can nevertheless use a much more modern mouse than the original Atari model. The Atari's mouse port (9-pin D-connector) is located underneath the keyboard. The rather long PS/2 converter just about fits in the small area, while leaving enough room to attach the actual mouse cable. These interfaces are custom made and thus quite rare, I was lucky to stumble upon a PS/2 adapter at the Atari Fachmarkt, before the shop closed.

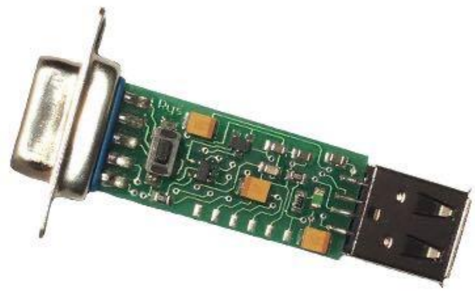


Figure 7: The Adapter for a PS/2 mouse for the Atari ST

(Source: Marin Balabanov)

The next input device I wanted to try was a graphics tablet called the **ArtPad II**. It is attached to the computer using the serial port and requires drivers to work with the Atari. Unfortunately, I never could find drivers for the art pad, given that this is a very old graphics tablet that was a niche product for the Atari ST. This was not a critical component, so I let it be, and instead used the mouse to draw. I bought the ArtPad II on eBay.

Figure 8: The ArtPad II

(Source: http://interface-experience.org/objects/wacom-artpad-ii/)

Finally, I added a Local Area Networking (LAN) cartridge called **NetUSBee Mini** to the Atari. Originally, I had intended to use it to exchange information with another computer using a LAN cable. Yet, the available options with the two different SD card solutions I had installed proved to be sufficient. The slow transfer speeds and the fussy connection of the LAN cartridge made it redundant and I never ended up using it beyond the initial installation phase.

This product I also purchased from lotharek.pl, fine purveyors of retro hardware.

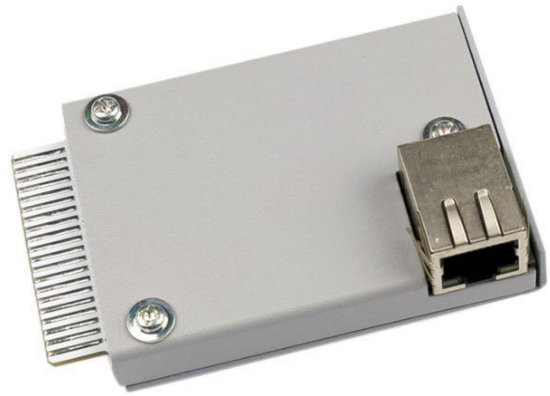


Figure 9: The NetUSBee Mini

(Source: https://lotharek.pl/productdetail.php?id=46)

The Upgrade Procedure

Now that I’ve reviewed the end state of the Atari Mega STE with all of the newly expanded hardware capabilities, I'll outline the upgrade process.

I took apart the Atari Mega STE by detaching all cables and unscrewing the bottom of the system unit. I detached all the cables leading to the floppy and to the LEDs for drive activity and power. This gave me full access to the main board of the Atari.

Figure 10: Taking apart the Mega STE's case to replace the internal floppy disk drive (Source: Marin Balabanov)

First, I upgraded the floppy disk, the hard drive, and the fan. The floppy drive was a drop-in replacement for the SD HxC drive. I simply unscrewed the floppy drive and then replaced it with the HxC. I had to make sure that the power cable and the floppy connectors are attached in the correct orientation and that the DIP switches on the HxC drive are set to the correct configuration. Due to the difference in size, some screws were left over. I removed the hard drive, but did not replace it with the UltraSatan, because I had opted to use it as an external device, leaving the internal SCSI port vacant for future use. I attached the power and the monitor to the Atari to test the HxC floppy emulator. It would have been a bit of a chore if I had reassembled the computer only to find out that the drive was non-functional, thus compelling me to disassemble everything once more to fix it.

Figure 11: The installed HxC Floppy Drive Emulator (Source: Marin Balabanov)

Once I was sure the device worked, I needed to provide the opening in the case for me to insert an SD card into the HxC once the case is closed. I had to break open part of the case because the HxC needs a bit more space than a regular floppy drive. I filed away the excess edges until there was sufficient room for the HxC drive

The next step of the operation was the most complex. I wanted to replace the old fan with a new **Noctua NF-a6c25 FLX** I got on Amazon. The old fan was quite loud, which was not unusual for the time, but technology has moved on since then and the new fan of exactly the same size, draws less power and is much quieter. In fact, I'd go so far that it is so quiet as to be being unnoticeable during regular operations.

Figure 12: Replacing the fan with a new low-noise fan from Noctua

I found the appropriate installation instructions on retro fan DBug's blog: http://blog.defence-force.org/index.php?page=articles&ref=ART45

To remove the fan, I needed to detach the power supply and remove it from the case. This was a bit fiddly but allowed me to unplug the old fan. Once that was done, I replaced it with the new fan in the same position. I gave the motherboard a final clean up with some compressed air and then launched attached the power supply and screwed it in place. Before reassembling the case, I gave it a final test run to see if the machine draws power as intended. Once that was clear, I meticulously reassembled the computer again.

Figure 13: The Framemeister mini xRGB attached to the Atari Mega STE with all necessary adapters (Source: Marin Balabanov)

The final result of all the travails is an Atari Mega STE with 4 MB of RAM, eight virtual hard drives extending across two SD cards on an Ultra Satan, a HxC floppy drive emulator for data exchange, and a network cartridge for LAN.

Figure 14: The "new" PS/2 mouse (left), the PS/2 adapter fitted into the external keyboard (right)

The machine is connected to an LG HD LCD screen display using a Framemeister. And the mouse is an optical PS/2 mouse connected using an adapter for the 9-pin D-Connector.

Now that the hardware is prepared and ready for use, we can move on to the software.

Figure 15: The UltraSatan with the two prepared SD cards sitting on top of the Framemeister (left), and the ArtPad II attached to the Atari STE (right)

Figure 16: The finished upgraded Atari Mega STE with all Peripherals

Why not use an emulator or an FPGA?

The big question in this project is likely why I insist on using original hardware and not simply use emulation on a modern machine?

Here, I will have to take a step back to explain. I understand that it seems ridiculous to upgrade a thirty year old computer with current day storage devices (SD cards), a newer input device (PS/2 mouse) and a modern day display (HD LCD), instead of simply using a new computer which comes out of the box with these features and then simply run an emulator like Hatari (https://hatari.tuxfamily.org), an SDL-based Atari ST/E and Falcon emulator on MacOS, Linux or Windows, or the emulator STeem (https://sourceforge.net/projects/steemsse/) on Windows. I understand that it seems silly to use the old hardware, but only have little of the charm, e.g. by attaching a CRT (cathode ray tube) display and using an LCD (liquid crystal display) instead. Software emulators running on today's vastly more powerful hardware are not even bound to the same performance limitations of the original retro hardware. They can speed up the emulation and pretend to be much faster machines that could ever have been built from the old components.

Figure 17: The MiST FPGA model with MIDI ports

(Source: https://picclick.fr/MiST-13-FPGA-CLONE-COMPUTER-173823275503.html#&gid=1&pid=2)

To make things even more convoluted, I could use modern hardware that does not use emulation. MiST is an FPGA, i.e. a Field Programmable Gate Array. This is a custom designed integrated circuit that can be configured (field-programmed) to act and behave exactly like the original Atari ST hardware. Potentially, an FPGA can be much more compatible and cycle-accurate than a software emulator even on the fastest hardware. I own the MiST FPGA which as the name indicates is an FPGA originally designed to act as an Amiga and ST (hence am**Mi**ga **ST**), though there are a multitude of so-called *cores* (hardware abstractions that turn the FPGA into the processor and chips of the original hardware) for a number of retro systems including the Commodore 64, the Sinclair ZX Spectrum and QL, the Sega Master System, the original Nintendo Entertainment System, and many more 8-bit and 16-bit systems.

Again, I return to the question: Why use the original hardware?

First of all, the available Atari ST/E emulators no matter how accurate and compatible are optimized for the vast *games* library available for the machine. Graphics applications do run perfectly fine on Hatari and STeem, but the devil is in the details. When drawing every single pixel using the mouse, the tiny timing differences become apparent. The way the old mouse works, as finicky as it is, introduces an ever so slight lag or erratic behaviour that makes it exceedingly cumbersome to draw the total of 640,000 pixels over five pages (where each page is composed of two screens at 320 x 200).

And I must say, that the mouse behaviour is slightly off in emulation, even though it is not noticeable when playing games. Though it may be counterintuitive, it is also an issue using an FPGA.

Figure 18: The MiSTer FPGA (Source: https://manuferhi.com/p/mister-fpga)

Second of all, I want to be as close to the original experience using the original hardware as necessary, but not suffer from the unreliability that the spinning disk drives, and old CRT might have by now.

I don't want to lose my work because of a data loss due to a failing disk drive or hard disk. While I love the aesthetic of pixel art on a CRT where the scanlines meld together, I don't want to risk the project because a CRT starts breaking due to old age. The Atari ST/E provided a notoriously bad video signal. In the color display modes, its vertical frequency in the European PAL region was 50Hz and 60Hz in the US NTSC region. But it's horizontal scan rate was a paltry 14.4Hz, which made the original Atari ST unusable with a VGA monitor of the time, unless it was a rare Multisync model. Using a CRT for extended periods of time is also not feasible because it tires the eyes. We might have put up with this thirty years ago, but if using a CRT *can* be avoided today then damn well should be.

Finally, the upgraded retro setup does in fact introduce tiny discrepancies and irritations. I did not use the original Atari ST mouse with the ball for movement tracking, opting to go with a late 90s PC mouse that used infrared to track movement across a surface. The PS/2 to DB8 adapter I used to attach the newer input device does an admirable job, but the PC mouse communicates movements slightly faster than the original one. The IR sensor is much more sensitive than a moving ball with two rolling pins, it samples the mouse movements at 1200dpi as opposed to the original approx. 200dpi of the Atari mouse. This makes the mouse pointer move faster than it should. I managed to mitigate this by using a small but useful application that was originally designed to accelerate mouse movements. Instead of its intended purpose, I used it to slow down the mouse pointer speed sufficiently to reduce the movement to the original speed.

There is one more thing that speaks for the use of original hardware: The build quality. Some of the devices from the 1980s and early 1990s were much more solid and reliable than nowadays devices. This was not only due to "things simply being better back in the day." All computers had to comply with much stricter radio interference standards, and as a result, needed to have bulkier shielding which made them heavier. Particularly the predominant desktop computers of the day were less prone to breakage than today's mobile devices like notebooks, tablets and smartphones by virtue of being seldomly moved.

As long as the original hardware is available and functional, and as long as it can be made to interface with modern day storage and display devices it will always be the more authentic experience and work as originally intended.

Figure 19: Another view of the fully equipped and upgraded Atari Mega STE, ready to create pixel art comics (Source: Marin Balabanov)

III. The Art Software

NEOChrome as the Chosen One

I chose to produce the artwork in **NEOChrome**, one of the simpler paint applications on the Atari ST.

NEOchrome was the first paint program developed for the Atari ST line of computers. While it is primitive by nowadays standards, NEOChrome offers many features that were not common at the time. Today we would classify it as a bitmap graphics editor for editing "raster" or "bitmap" images, i.e. images made of pixels as opposed to vector graphics that are made of lines and curves.

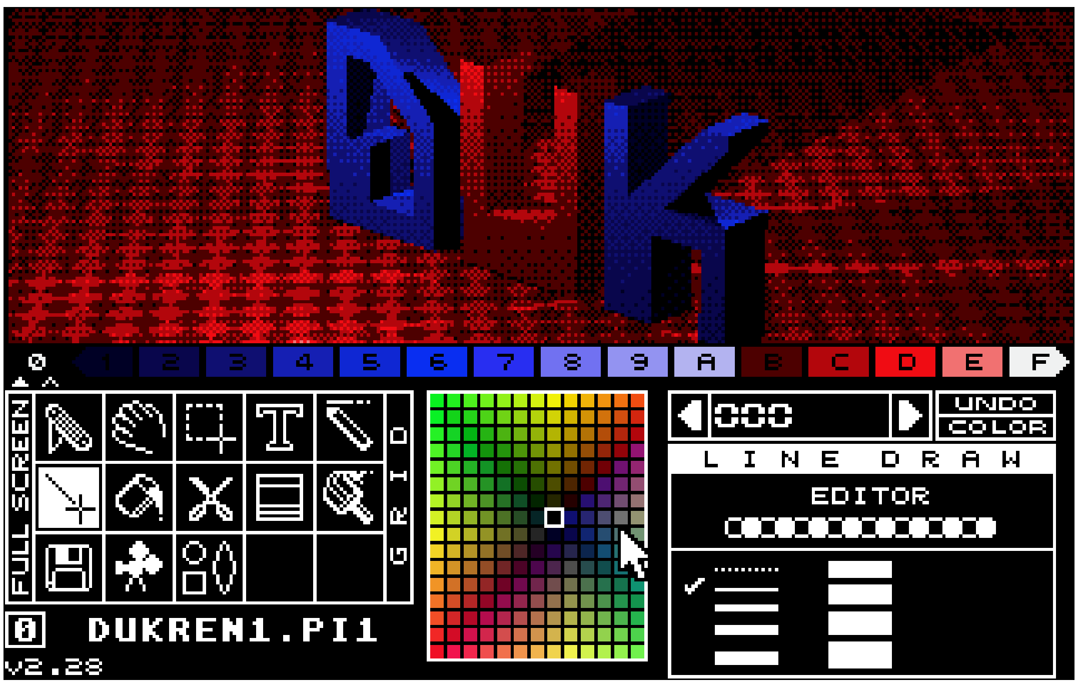


Figure 20: NEOChrome on the Atari ST features many of the same tools as MacPaint e.g. line and pencil tools, copy and paste tools, and a text tool. Moreover, it provides powerful rastered color palette (middle) and basic animation tools. (Source: Marin Balabanov)

The Atari ST offered an overall palette of 512 colors. However, in its low-resolution mode of 320x200, only 16 of these colors could be displayed on-screen at the same time. At 640x200, its medium-resolution, only four colors could be used and only monochrome black and white in high-resolution at 640x400. I decided to use the low-resolution mode with its 16 colors, because this was the standard maximum. This is quite a challenge, considering that the human eye can distinguish millions of colors.

NEOChrome was developed at the Atari Corporation as a tool to create graphics during the initial development of the Atari ST. It was written by Dave Staugas, a programmer at Atari and co-author of the ST's operating system. Early versions of NEOChrome introduced a nifty animation feature called color-cycling. Cycling through the colors of a part of the palette would look like limited animation.

NEOChrome adhered to some of the established user interface elements of Apple's MacPaint, which had been introduced in 1984 on the original Apple Macintosh. It does have a slight resemblance to MacPaint by using icons for the tools and the mouse to draw with.

The user interface of NEOChrome provides many of the same tools as paint applications of the time. You could draw freehand, draw lines and shapes, fill areas, you could copy and paste, and you could add rudimentary text. By today's standards, these are very pedestrian features that had been established by MacPaint a year prior and arguably by paint applications on 8-bit computers like Koala Painter on the Apple II and Commodore 64. NEOChrome did deviate from the MacPaint-paradigm in one key aspect: the tools area occupied the lower half of the screen and permanently showed a magnification zoom at the tip of the drawing tool while it traversed the canvas (more on this below).

The advanced version, called NEOChrome Master, which also allowed for simple page flip animation could rotate copied screen areas in small increments and play chiptune music in the background during a user's long drawing sessions.

The Zoomed View

It is important to remember NEOChrome was a color paint program and the image background was black by default as opposed to the white canvas of MacPaint. In NEOChrome, you could only see the top half of the painting canvas, while the bottom half was occupied by the color palette and the tools. At the first sight, this might seem like a big disadvantage considering the small screen, but the bottom part of the screen also provided two ingenious features.

Whenever the user moved the mouse cursor onto the painting canvas, a part of the bottom half of the screen turned into a magnifying glass that showed each pixel in the area of the cursor. This zoomed view updates in real-time and follows the cursor everywhere it went, so that the user could at all times see exactly which pixels they were working on.

Color Picker

Whenever the mouse cursor returned to the lower half of the screen, then the magnifying area reverts to a palette of colors. Now, this is where things get complicated. On a bare technical level, the original Atari ST can only simultaneously display 16 colors on the screen from an overall choice of 512 colors, but in NEOChrome, you can actually see many more colors and pick which hue to add to your palette from 195 colors that are displayed in 13 by 15 color boxes the tools area. You can move the focus of the color selection field to show different colors from the full total of 512.

The extended NEOChrome Master

Atari Corporation distributed NEOChrome to Atari ST owners for free. This meant that Dave Staugas did not receive the royalties from actual commercial sales. So, he decided to no longer develop the application. Staugas had hidden some of the features he was not yet satisfied with, particularly the animation feature. Though he did leave a way to enable the albeit not bug free feature for more adventurous users. In the meantime, many pixel artists had adopted NEOChrome as their favorite paint application because of its speed and the permanent onscreen zoom.

In the early 1990s, programmers from the German demo group Delta Force disassembled NEOChrome's binaries to get the source code and, even though they were working in unfamiliar code, they started extending the functionalities. They reintroduced the hidden animation feature, added some more drawing tools, and improved the rotation feature to rotate objects by single degree increments as opposed to the previous 90-degree steps.

By then, the new Atari STE that had slightly extended capabilities had been released. The new machine was still straddled by the 16 color limitation, but the overall available colors had been increased to 4096, which meant that color ramps and gradients were much smoother.

The new programmers from Delta Force now adapted NEOChrome to take advantage of the STE's extended colors.

What do all the Bits mean?

The Atari ST and Atari STE used a Motorola 68000 central processing unit (CPU). This was generally described as a 16-bit processor. The machine’s architecture was 16-bit and the processor communicated with the memory and all other chips using 16-bit lanes. Internally, the Motorola 68000 had a 32-bit architecture. This meant that the general purpose registers were 32 bits wide and most arithmetic instructions supported 32-bit arithmetic. Potentially, a computer using a 68000 CPU could address a maximum of 16 megabytes of RAM, though in practice, the Atari ST/STE could only be upgraded to 4 MB by default.

The CPU is not the only area, that bits come into play. We have discussed the graphics limitations of 16 colors out of a total palette of 512 colors. The Atari ST’s display hardware had a Digital-to-Analog Converter that used 3-bits for each color. This means that eight levels for each RGB channel (red, green, and blue) could be displayed. So, the overall RGB palette of 512 colors had 9-bits. The STE models had a Digital-to-Analog Converter with 4-bits, i.e. sixteen levels per RGB channel, this made a 12-bit RGB palette with 4096 colors possible.

But enough about bits, lets discuss the actual colors.

512 Colors vs. 4096 Colors

When Atari released the very first STE model of their line-up in 1987, it was a bit of a disappointment. The “E” in STE stood for enhanced. It was supposed to compete better with the Commodore Amiga with its advanced graphics and sound using Commodore’s custom chips. The STE’s enhancements were not sufficiently competitive, so they were not widely adopted by developers of games and other applications. While the regular ST had a palette of 512 colors with a limit of 16 colors on-screen at the same time, the enhanced STE had an overall palette of 4096 colors which allowed for finer gradients and shading, but it was still limited to the same 16 colors on-screen at a resolution of 320 x 200 pixels. Compare that to the Commodore Amiga that was release two years prior to the enhanced Atari STE.

In the most common color graphics mode at 320 x 200, the Amiga could display 32 colors from its palette of 4096. Once you started to use the less standard modes, you could display 64 colors in “half-brite” mode, where a user defines 32 colors and the Amiga automatically provided the same colors in half their brightness. This might sound a bit cumbersome because a user could not arbitrarily choose all colors in the 64 color palette, but the halfbrite colors could be used for much smoother shading.

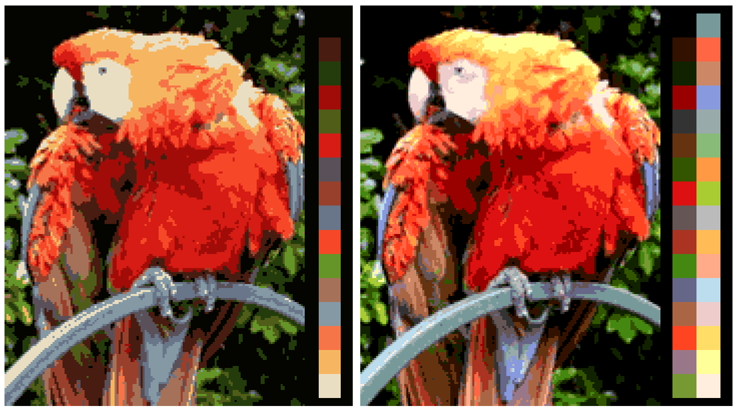


Figure 21: The regular Atari ST's 9-bit color palette (left), compared to the Commodore Amiga's 12-Bit color palette (right) (Source: https://en.wikipedia.org/wiki/List_of_monochrome_and_RGB_palettes)

The Amiga provided the ultimate mode for static images (i.e. not well suited for action games) called the Hold and Modify mode (HAM). This effectively abolished all color limitations, and images on the home computer could use 4096 colors at the same time. Coupled with the washed-out video displays of the day, this came close to photorealism.

The Atari STE’s “enhanced” graphics did not quite provide the Commodore Amiga’s features. You were limited to 16 colors out of an expanded palette. Given these graphics features, what was the point and was it important to pixel artists?

The main difference between a palette capable of 4096 colors and that of 512 colors are the finer graduations between colors. The minimum “steps” in intensity that the enhanced STE’s 4-bits per RGB channel allow for, are smaller than the standard ST’s 3-bits per RGB channel. While the limitation of 16 simultaneous colors is quite a constraint to work with, having a larger available palette to choose from allows an artist to work with finer shading.

Tangent: Overcoming the Atari ST's 16 Color Limitation

Some of the more perceptive readers of this document might rightfully ask: if the Atari ST can only display 16 colors on-screen at the same time, how can NEOChrome show 195 colors to pick from on the bottom half of the screen?

This is where **palette-switching** comes in. Dave Staugas, the developer of NEOChrome, used a software technique to traverse these hardware limitations. While it is true that an Atari ST screen can display 16 paletted colors, Staugas takes advantage of the way the screen builds an image. On a Cathode Ray Tube (CRT) monitor, the image is built line by line from top to bottom as the cathode ray traverses the width of the image. This happens so fast that a full screen is projected 50 times per second (in the European PAL TV standard) or 60 times per second (in the North American NTSC TV standard).

Staugas wrote the NEOChrome color palette in such a way that he took advantage of the precise timing that the individual scan lines need to display the full image. In the tools section, he switches the palette of the available 16 colors while the image was being built on the screen - every five or so pixels in the color picker section. This allowed him to overcome the hardware limitations of the Atari ST through clever programming.

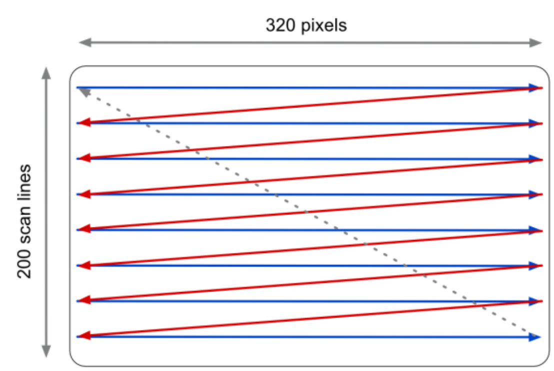


Figure 22: Illustration of the path of the electron beam on a CRT display

(Source: Marin Balabanov)

Interrupts of the processor were occasionally used to swap out the 16 colors of the palette part way through drawing the screen. The most straightforward way was to do this at the start of every raster line. Then every line drawn on the screen had its own palette.

Applications far more advanced than NEOChrome could change the palette in the middle of a line to achieve 48 colors per line. This method is much more computationally intensive and requires precise timing of the display hardware.

Alas, this programming trick was only used for the comfort of the user, so that they can select the right color for their 16 color palette instead of putting each individual hue together from its RGB values. This does not mean that pixel artists could actually paint in more than 16 colors on the screen.

There were other paint programs that used the same advanced programming techniques to transcend the original limits of the ST's hardware and enable pixel artists to use as many of the 512 colors available on the Atari ST in their pictures at the same time. The big disadvantage of these tricks is that the more colors you use beyond the limitation, the slower the application becomes. The Atari ST's Motorola 68000 CPU needs to put in the extra work to switch palettes at every scanline, or even multiple times per scanline. The most famous paint applications to use the palette-switching trick were Antic Software's Spectrum 512 (1987), GFA Systemtechnik's GFA Artist (1987), and Eidersoft's Quantum Paint (1988).

For the purposes of this project, we will focus on the Atari ST's native limitation of 16 colors.

The Right 16 Color Palette

Now that we have gone through all the technical aspects of colors on the Atari ST/STE, the next big decision was to select the *right* colors. The easiest method is to pick three main colors e.g. blue for the sky, a skin color, and green for the forest backgrounds and then simply create four or five shades (ramps) for each. If you account for white and black, this occupies all 16 colors.

I didn’t want to use the *easy* method. This is limited and makes the resulting palette to miss the brown tones needed for the trees, as well as the grey tones needed for some of the other characters in the comic.

Putting together a versatile palette with only 16 or 32 colors has been the holy grail for many a pixel artist. Fortunately, the community at the pixel art platform called Pixel Joint (pixeljoint.com) has been slowly chipping away at this problem over the decades. There have been a number of strong and versatile palettes put together by community members, but the general consensus is that the best 16 color palette was put together by the user Dawnbringer. He has created three powerful palettes, one called DB8 with 8 colors, another with 16 colors called DB16, and DB32 with 32 colors that can be used on a Commodore Amiga. He has made the palette available on Github for general use at https://github.com/geoffb/dawnbringer-palettes DB16 is particularly well suited for the Atari STE because it uses only 16 colors, but requires 4-bit 4096 color palette.

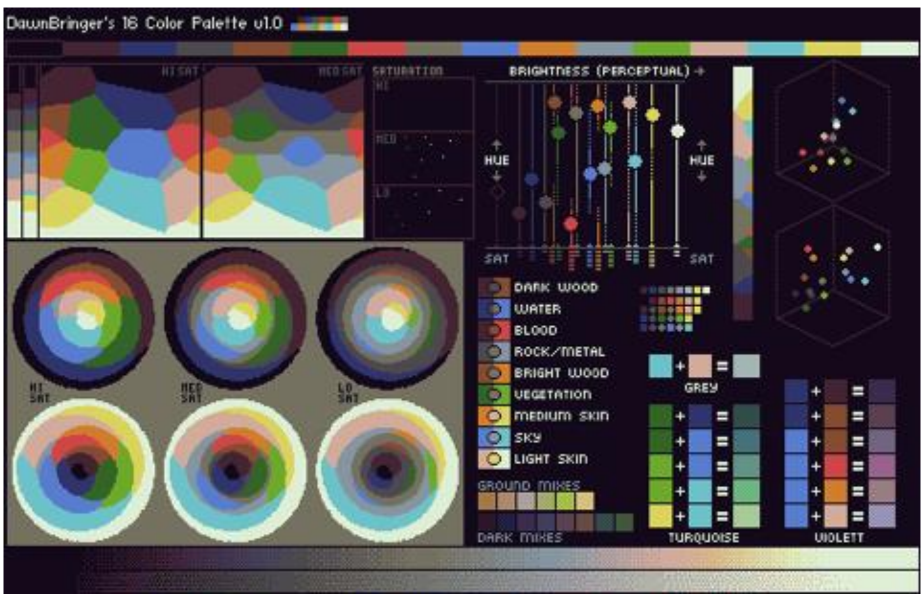


Figure 23: DawnBringer's DB16 color palette... yes, these are only 16 colors!
(Source: http://pixeljoint.com/forum/forum_posts.asp?TID=12795)

Dawnbringer's DB16 colors do not use straightforward ramps for each of the "main" colors, rather, the colors occupy a very wide range of hues, while some colors provide different intensities. This allows them to be combined with each other, depending on whether a specific object should be shaded from light to dark or from one hue to another without any change in brightness.

Let’s look at an example. DB16 has three widely different tones of blue, three grey tones, two brown tones, only two greens, orange, a Caucasian skin tone, and yellow. The brightest color is not white, but a bluish off-white. The darkest color is not pure black but an unbalanced dark grey with a nearly imperceptible blue tinge to it. This smart selection of colors enables an artist to ramp from dark to light in different combinations. Instead of using a light green and then make a gradient to slightly darker shades of green to end up in a dark green and black, the artist can set the two green tones in the middle of the intensity, but use dark brown and the dark off-gray for the darker gradients, while using yellow and the bright off-white for the lighter sections. This method can be used to create admittedly limited and perhaps not extremely smooth ramps for each of the colors, but it creates the impression that there are many more colors available.

I chose to adopt Dawnbringer’s DB16 palette for the comic story.

Pixel Art Techniques

Before we jump into the actual creation process, I would like to describe two standard techniques in pixel art that I used for the comic art: Dithering and Anti-Aliasing.

Dithering

Even using the expanded Atari STE color palette, the perceptible differences in intensity between different tones is too great and jarring even if two related tones are used for large adjacent areas. They will then look like two distinctly colored areas. Dithering individual pixels between the two colored areas makes them blend together better.

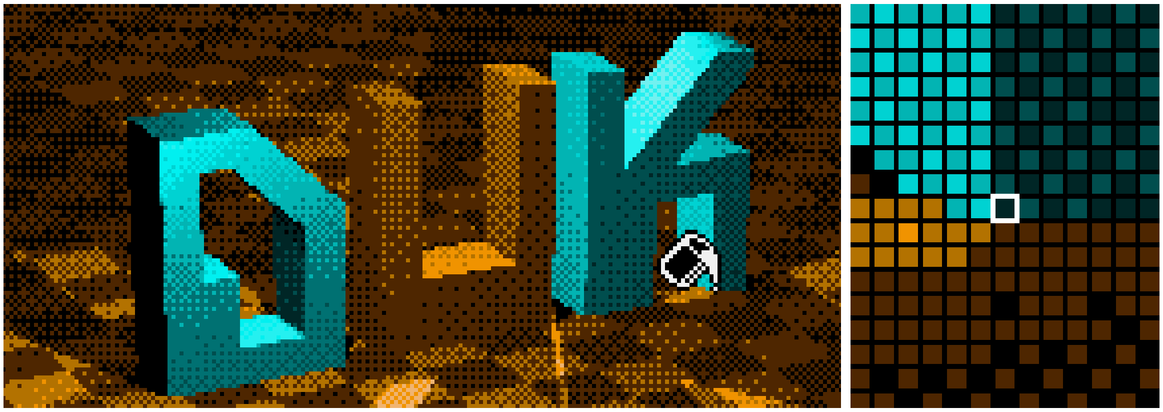


Figure 24: Dithering creates smoother gradients (left), as seen in the zoomed view of the interspersed pixels of alternating color (right) (Source: Marin Balabanov)

At the intersection between the two colors, the artist begins to color one pixel with a color and then the one next to it in the other color. They then continue to do this chess board style effect along the intersection between the colors

Anti-aliasing

The low resolution of the pixel art on the Atari ST creates jagged edges when drawing curves and circles, particularly when the contours have a very contrasting color to the background. These “jaggies” are called Aliasing. The edges can be counteracted by adding pixels of the intermittent colors between the jagged edge and the background.

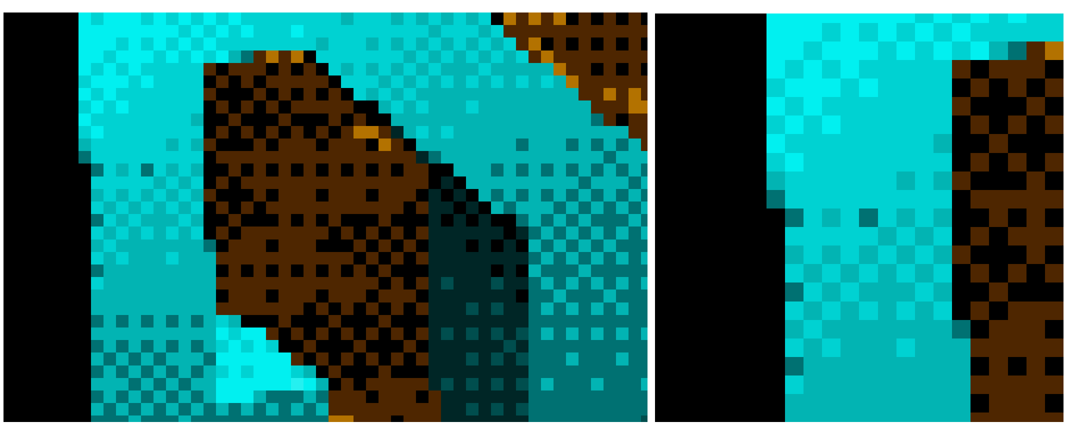


Figure 25: Placing shaded pixels between areas of high contrast diminishes the jagged steps between pixels and slightly offsets the low resolution (Source: Marin Balabanov)

Combining Images to Single Page

As a true pixel art application, NEOChrome restricts the available canvas size to the screen size and resolution. This means that I can only paint in 320 x 200, giving me a horizontally rectangular canvas. The objective of the project is to produce five comic pages. A regular printed page is vertically rectangular. I decided to solve this by painting half the printed page as a screen in NEOChrome. This means that for each printed page, I created two images at 320 x 200 each.

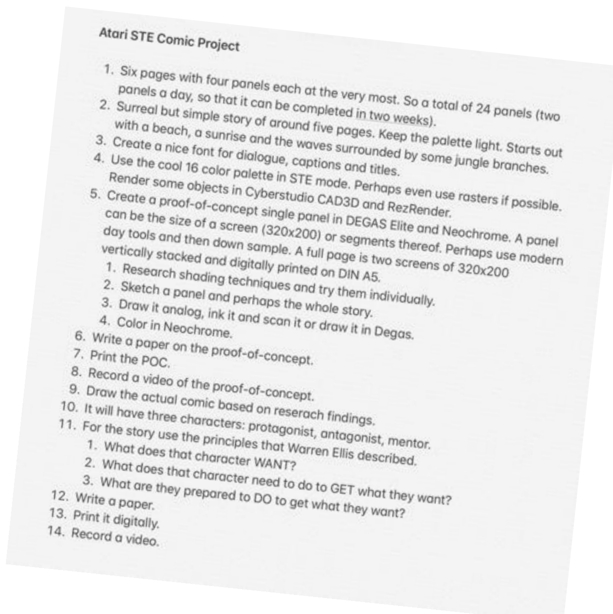
When I had completed all of the half-page images, I exported them in IFF format. Ironically, this is the Interchange File Format originally developed on the Atari ST's competitor Commodore Amiga. I needed to be able to maintain the expanded STE colors. This is not supported by the standard ".NEO" format of NEOChrome.

I then loaded up the image halves into another piece of art software on the Atari ST called *Invision Elite Color*. There, I combined the image pairs into single pages of 320 x 400.

IV. Drawing before Pixeling

Planning the Story and Designing the Visuals

Now that all the hardware and software are set up and in place, I can start with the actual comic. I went through a couple of drafts for the story. At first, I wanted to write an original story and draw that, but then, I decided that this would take too much focus away from the actual task at hand: drawing the story.



Atari STE Comic Project

1. Six pages with four panels each at the very most. So a total of 24 panels (two panels a day, so that it can be completed in two weeks).
2. Surreal but simple story of around five pages. Keep the palette light. Starts out with a beach, a sunrise and the waves surrounded by some jungle branches.
3. Create a nice font for dialogue, captions and titles.
4. Use the cool 16 color palette in STE mode. Perhaps even use rasters if possible. Render some objects in Cyberstudio CAD3D and RezRender.
5. Create a proof-of-concept single panel in DEGAS Elite and Neochrome. A panel can be the size of a screen (320x200) or segments thereof. Perhaps use modern day tools and then down sample. A full page is two screens of 320x200 vertically stacked and digitally printed on DIN A5.
   1. Research shading techniques and try them individually.
   2. Sketch a panel and perhaps the whole story.
   3. Draw it analog, ink it and scan it or draw it in Degas.
   4. Color in Neochrome.
6. Write a paper on the proof-of-concept.
7. Print the POC.
8. Record a video of the proof-of-concept.
9. Draw the actual comic based on reserach findings.
10. It will have three characters: protagonist, antagonist, mentor.
11. For the story use the principles that Warren Ellis described.
    1. What does that character WANT?
    2. What does that character need to do to GET what they want?
    3. What are they prepared to DO to get what they want?
12. Write a paper.
13. Print it digitally.
14. Record a video.

Figure 26: The very first original outline for this project from 2018

(Source: Marin Balabanov)

The Story

There is a decade old joke in many totalitarian states about a competition between three intelligence or security services from different countries. The joke comes in many permutations, but usually it is about an American intelligence service, an Israeli or British service, and the local intelligence service from the totalitarian country the joke comes from. The first time I heard the joke, it was about the Soviet-Union, then I heard a variant from Syria. When researching the joke for this project, I found that there are versions from Eastern Germany and North Korea as well.

The original joke goes something like this:

Three intelligence services have a competition to determine who is the best. The referee releases a mouse in a forest and then sends in a contender from the first service to find the mouse. After a day they return with the mouse. They are successful, but the time they needed was rather long. Another mouse is released into the forest and a member from the next service goes in to find it. They return with the mouse in a ridiculously short time. They are not only successful, but they are really fast.

Finally, the referee releases another mouse and a member of the last intelligence service goes in to find the mouse. Now please keep in mind that this is the local service from the totalitarian state like the Soviet Union or the German Democratic Republic. The last contender is not seen for hours, then days pass, and after a week they return. They bring back an elephant.

The referee is shocked. They protest that the animal the intelligence person brought back is not a mouse! Then the elephant says: "Yes! Yes, I am! I confess to everything. I am a mouse."

The main message of the joke is that the local intelligence service of the totalitarian state is quite incompetent, but they get results at any costs. In this case, they tortured an elephant until it confesses to be a mouse.

As a project for a university course with the focus on the media aspects, I definitely did not want to get into any slippery political territory and use countries that actually exist. This would detract from the objective and perhaps be the cause for unnecessary discussions. So instead, I decided to use alien characters with superpowers on a different planet. Though to be fair, I did make sure that they are human-looking and perhaps even have a bit of the characteristics of the contenders in the original joke.

The Synopsis and the Breakdowns

Once I had decided which story to use, I drafted up a synopsis of the story. I split the rough synopsis into an approximate page count, attempting to keep to around four pages, as originally planned. The result was a synopsis of five pages with five to eight panels each, because I needed more room for the story. The synopsis also enabled me to note how many characters appear in the story, which settings will be needed, and the props required.

Then I drew the so-called thumbnail breakdowns, i.e. tiny layouts of each page. As a result of the thumbnails I realized that there are a couple of key panels missing, and I adjusted the story accordingly.

Based on the character list, I sketched the figure with a technical pencil working my way from basic shapes to a tight pencil sketch. Then I cleaned up the contours with a technical pen. I erased the pencil lines and with a black marker or brush pen, I then re-enforced some of the lines and fill in the blacks where they were needed.

This particular story needed four character, two backgrounds (mostly consisting of trees), a mouse and an elephant. The story was set outdoors in front of a forest.

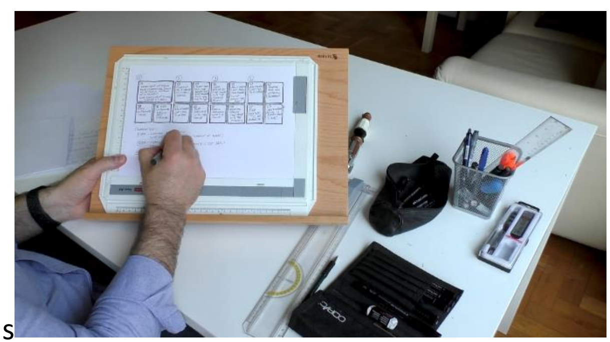
s  

Figure 27: Creating the thumbnail layouts (top left), sketching the one of the characters (top right), drawing the backgrounds (bottom left), finishing the mouse character (bottom right)

(Source: Marin Balabanov)

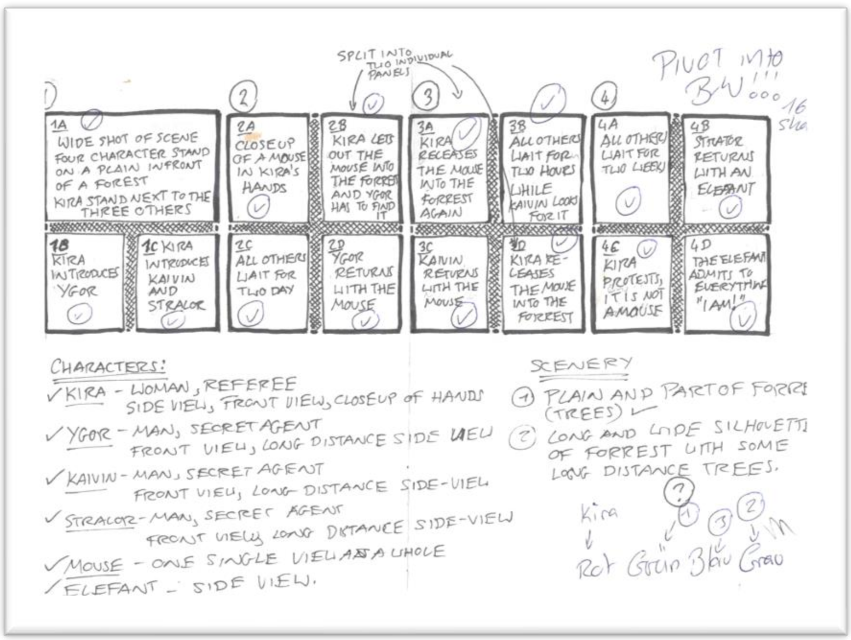


Figure 28: The breakdown of the plot of the comic (Source: Marin Balabanov)

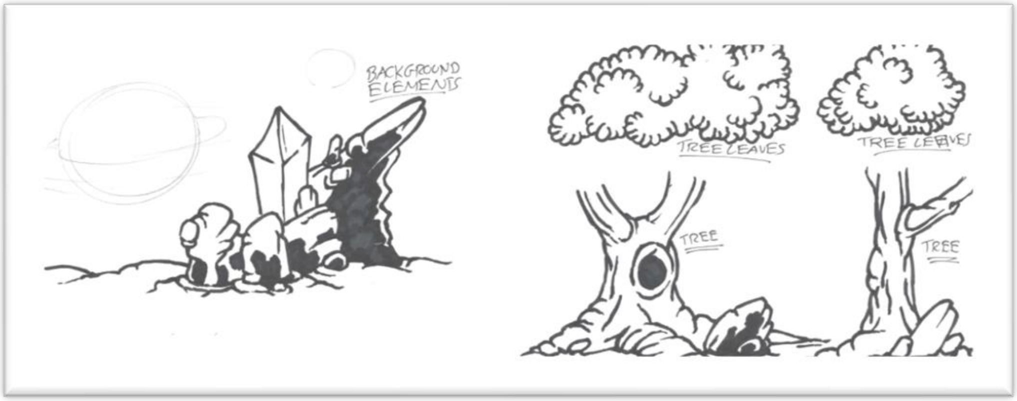


Figure 29: Some of the designs for the backgrounds (Source: Marin Balabanov)

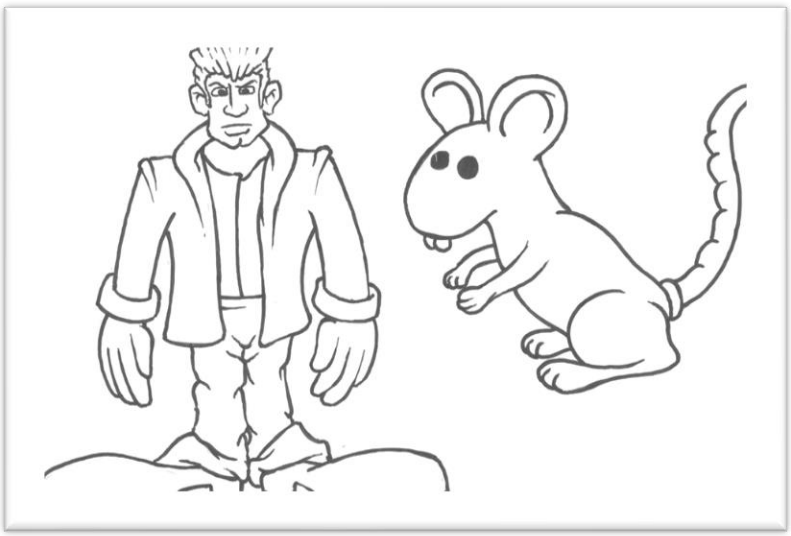


Figure 30: Some of the character designs (Source: Marin Balabanov)

Figure 31: Designs of components that will be composited together on the Atari STE (Source: Marin Balabanov)

Now that I drew the individual figures and the components of the backgrounds I scanned them using a flatbed scanner attached to my modern day MacBook Pro. This might seem contradictory to the original plan to use only original hardware, but I could have also done the scanning process on the Atari ST if I had managed to find and purchase a hand scanner. I could not find a suitable model. I then decided to scan the designs on the Mac and transfer them to the Atari ST to color them and manually render out each detail. This would give me flexibility to combine the panels any way I liked, and it saved time because I would reuse the same figure on multiple panels with only slight variations. The same is true for the backgrounds. I could repeat the backgrounds and overlay the relevant characters.

Figure 32: An ad for the MiGraph hand scanner in Start Magazine 4/1988

I scanned them on my Mac and then converted them into an old graphics format called IFF that first used on the Commodore Amiga. I saved the converted image files onto an SD card and then transferred them onto the Atari ST using the UltraSatan. Now, it is only a matter of converting them into the format of the paint application I want to use for the finished pixel art.

I was not sure how well I would be able to draw on the Atari Mega STE. So, before starting with the comic, I wanted to try my hand at a "proof-of-concept." I want to be mindful of the limitations of the Atari Mega STE.

Figure 33: Layouts and character designs

(Source: Marin Balabanov)

Proof of Concept

The process of pixeling every single detail is quite time consuming and tedious. That being said, it did put me in a trance-like state of complete focus. I worked my way through to a finished proof-of-concept of the elephant using different techniques to overcome the limitations. I used dithering for areas of color transitions and I manually anti-aliased the pixels that made up curves to offset the low resolution.

The elephant that I drew is a pivotal character in the story. I mainly focused on getting the colors right and making sure that the lines are cleaned up. The background will most likely be different in the final comic than it is in the proof of concept.

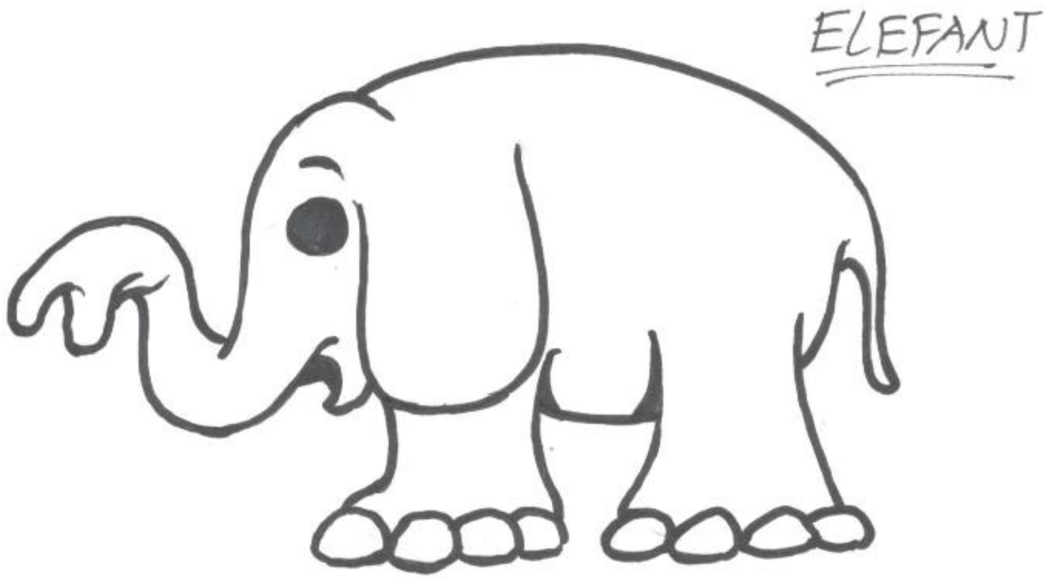
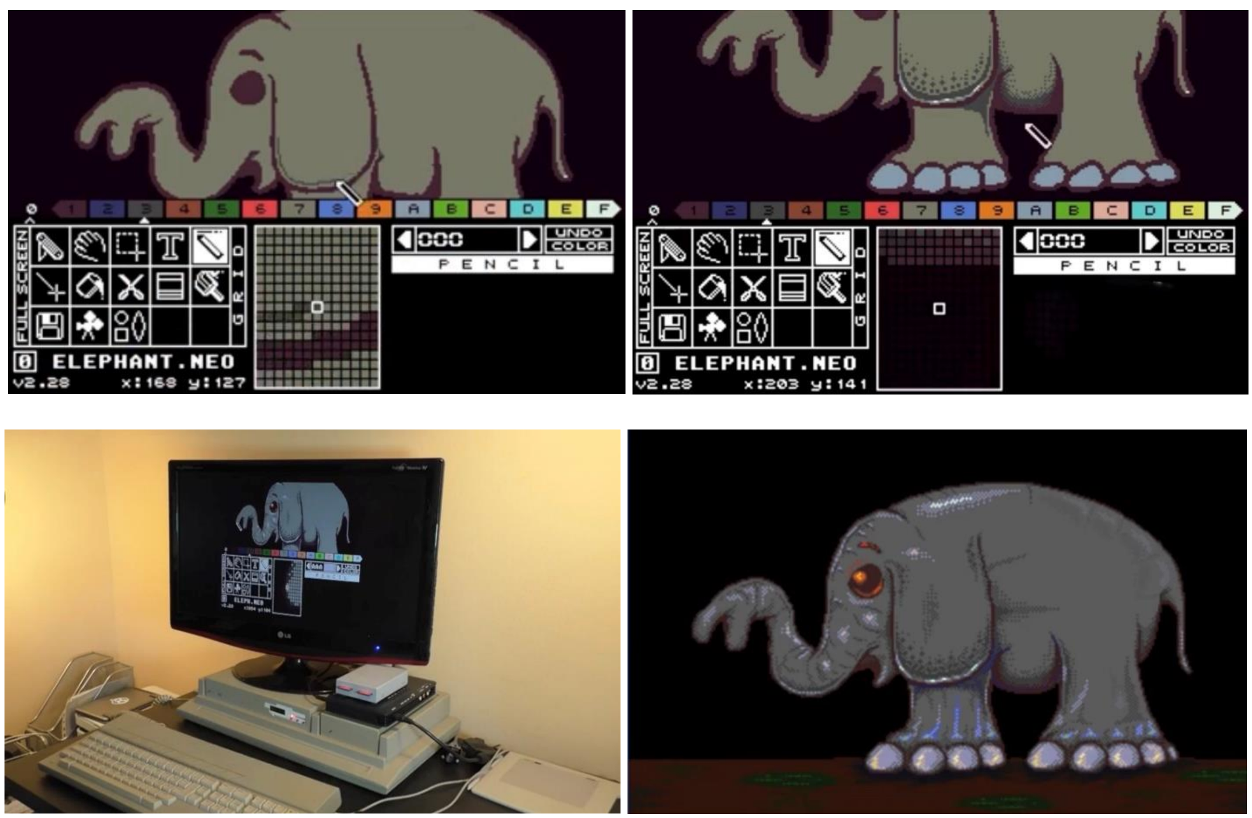


Figure 34: The pen and paper design of the elephant used as the basis for the proof-of-concept (Source: Marin Balabanov)



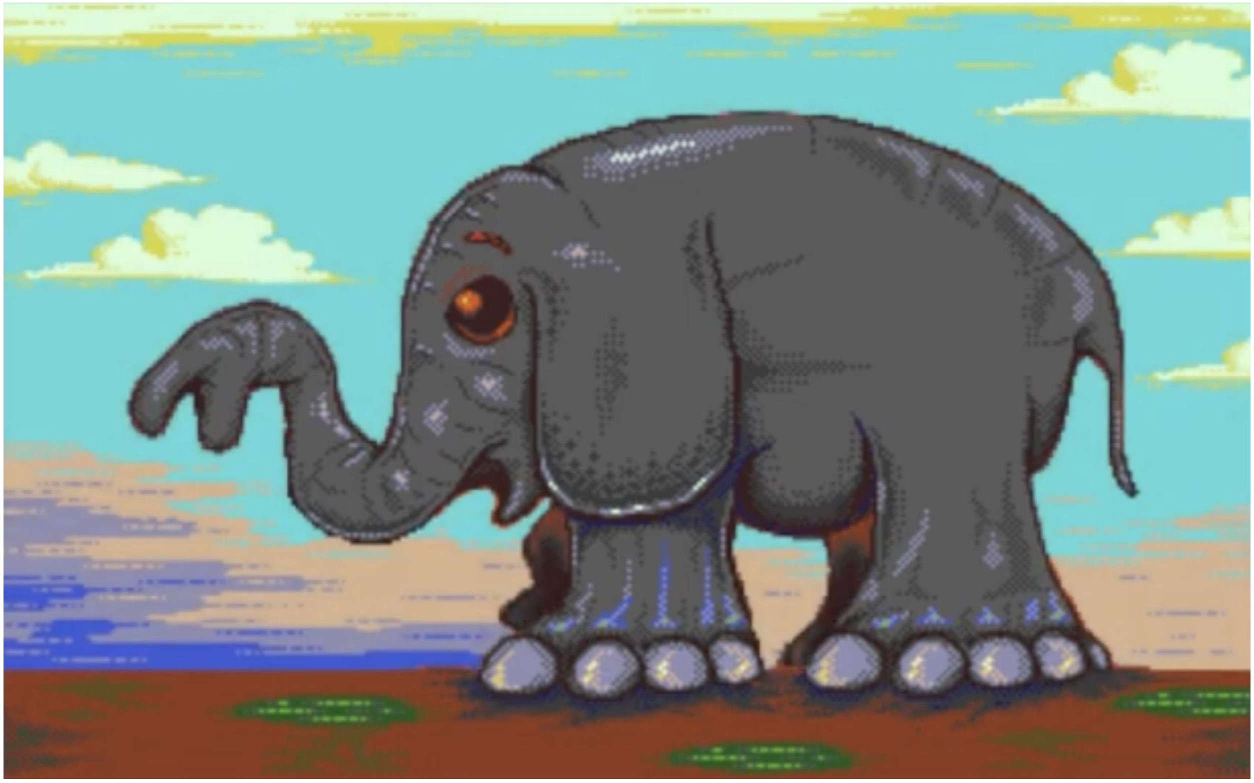


Figure 35: The steps in creating the proof of concept for the pixel art comic in NEOChrome.
For the final comic I redrew the elephant. (Source: Marin Balabanov)

V. Pixels all the Way

Pixeling the Main Comic

Full of energy and enthusiasm I started with the very first panel. It would be the scene setting image with a large title. At that time, I still wanted to call the story "The Elephant in the Room."

A False Start

I imported the scanned contours of trees, drew a coast line and a horizon, drew a logo like title with an elephants trunk acting as the letter "t", cleaned up the lines, meticulously pixeled all the colors and dithered all the shaded only to realize that...

This was all completely pointless. This was a false start. The scene is not set properly by showing a horizon with a sunset and a coastline without any of our characters. And I also realized that the title "The Elephant in the Room" is not suitable. To a certain extent it reveals the punch line. But most of all, it does not ring true. While the phrase "The Elephant in the Room" usually refers to an important matter at hand that is always overlooked or deliberately avoided, it is simply not suitable as the story's title. I am not sure where the darn elephant is, but most definitely it’s not in the room.

I therefore had to abort my work, scrap the panel and start again. It did pain me quite a bit to discard a passionately painted picture, but at least I can share it here in the project documentation.

Figure 36: The roughly colored version of the unused opening panel (left), and the finished version of the unused panel with the unused title and logo (right) (Source: Marin Balabanov)

Drawing Panels

This time around, I'd adhere more closely to my sketched out thumbnail layouts. The establishing shot should show the main characters of the story and their location in a clear manner. Additionally, it should have sufficient space for a title. I planned the panel to show our players standing next to the forest then the referee will later release the mouse.

Then I proceeded panel by panel and page by page to work my way through the story. The method was always rather similar: I copied the scanned elements to an empty image in NEOChrome, resized and pasted them where they belong. I filled in the gaps in the lines and cleaned up the contours. I filled the contours with the main color of the element (e.g. the contours of the referee’s hair are filled in red, the mouse is filled gray). Then I added the dark tones that create the shadows and shades in the shapes. This was followed by the highlights. To make the transitions smoother, I dithered the colors across each other. After another round of clean-ups, I anti-aliased any starkly contrasting contours.

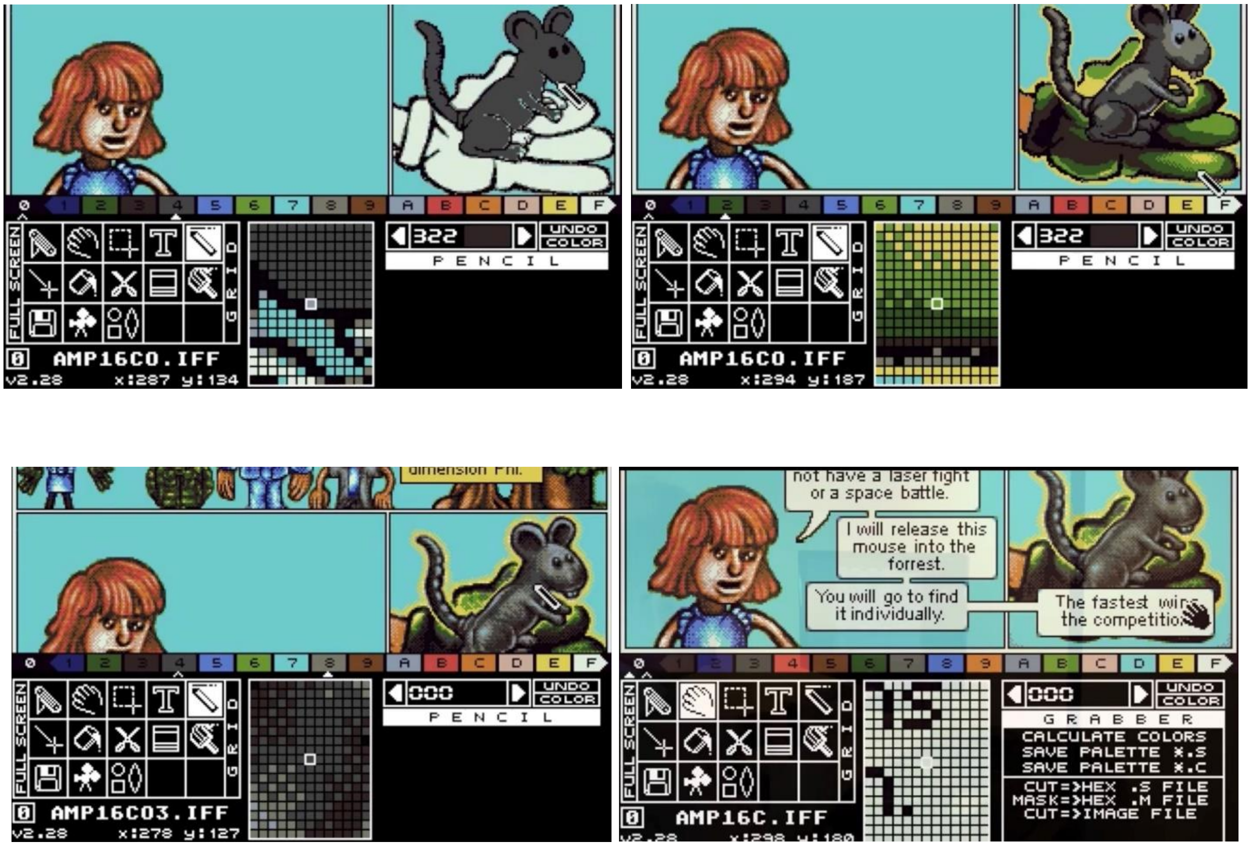


Figure 37: Pixeling a panel from the initial coloring and shading to the lettering

(Source: Marin Balabanov)

Lettering

After making another round of little adjustments like adding and removing a pixel here and there, I started lettering the panels. This was slightly more laborious than it would be using a more modern paint application, because NEOChrome does not have the concept of layers. Every letter and word will irreversibly cover the background it is placed over once I finish entering that line of text. I therefore needed to estimate the room necessary for each speech "bubble" and caption, then draw the necessary boxes to "reserve" the space. Then I selected the smallest legible font in NEOChrome and typed the dialog and captions into the available space. More often than not, this went well.

On several occasions, I had planned for too little space in a panel and had to start the lettering over again. Text handling is definitely not NEOChrome's strongest feature. The smallest font in the application produces odd spacing between the letters. I therefore had to manually adjust the spacing between every individual letter after typing them. In some cases I also changed the shape of the letter to make it better legible.

Compositing the Page

NEOChrome only allowed me to draw images of 320x200. This is an approximately horizontally rectangular aspect ratio. A full page requires two of these images stacked over each other. I could not do this in NEOChrome. So, whenever I finished the two halves of a page, I imported them into a different application: Invision Elite Color. This is an app developed with the successors of the Atari ST and STE in mind, the far more powerful Atari Falcon and the Atari TT, but it nonetheless ran on the Atari ST and the STE.

The version of Invision Elite Color I used was released in the early 1990s and was targeted towards print designs that used the Atari computers for desktop publishing. I never got the hang of using Invision to draw and paint, but the feature I wanted to use was its capability to create images of an arbitrary resolution.

In Invision, I created a new image with a resolution of 320 x 400 and then I pasted the two halves of each page together and saved them in the IFF image format.

Finishing the Comic

The old saying goes that every journey starts with a single step. Once the journey of pixeling each panel and every page was underway, I learned to complete each step faster and more confidently.

After around three weeks of on and off pixeling during free time, I finished the comic story. The journey was nearly over. Happily and proudly I could say: The project is finished.

Figure 38: The finished comics pages. Let's take a look at them in detail in the chapter after the next. (Source: Marin Balabanov)

VI. Creating Documentation

Video Recording for Documentation

When I started this project, I set my mind to documenting the steps as thoroughly as possible without being exceedingly boring or getting lost in details. I decided to record videos of the process of upgrading of the retro hardware, record videos of the initial sketches and story breakdowns, make screen videos of the actual pixeling and drawing process directly by capturing the video signal from the Framemeister upscaler attached to the Atari STE.

I recorded three videos that I uploaded to YouTube chronicling the journey to the finished pixel art comic.

I used two Panasonic HCV-180 HD digital camcorders on tripods to record the manual drafting and design process at the drawing board. I had two additional photo lights, one on a tripod, and one attached directly to the camera via the shoe.

Figure 39: The camera and lights setup for filming

(Source: Marin Balabanov)

For the captures of the Atari STE's screen I used an Elgato HD60 Game Recorder to feed the HDMI signal from the Framemeister into it, and then provide a pass-through to the monitor.

The elaborate chain of the Atari ST using a SCART cable, converting that to a composite video cable, attaching that to the Framemeister that needs a few milliseconds to upscale the video, feeding the Elgato HD60 and then finally reaching the destination of the LCD. By default, this adds a few milliseconds delay definitely introduced a slight lag between input and the video display, but that was barely noticeable. Furthermore, I only recorded a part of the drawing process, leaving the Elgato HD60 detached and using the Framemeister directly attached to the LCD for most of the time.

Figure 40: The Elgato HD60S (Source: elgato.com)

For the voice recording I used a small Sony voice recorder designed for office use (which explains the mediocre sound quality).

I used Final Cut Pro X on a MacBook Pro to edit and composite the disparate videos and audio files, adding some chiptune music I captured from YouTube videos of old-school demos.

The final results were rendered to HD and uploaded to YouTube. Together with the text of this document the videos can be found at http://marincomics.com/duk-pixelart/

Figure 41: Close-up of the camera and light setup

(Source: Marin Balabanov)

VII. The Future was 16-Bit

The Finished Pixel Art Comic

Figure 42: The first page of the pixel art comic

(Source: Marin Balabanov)

Figure 43: The second page of the pixel art comic

(Source: Marin Balabanov)

Figure 44: The third page of the pixel art comic

(Source: Marin Balabanov)

Figure 45: The fourth page of the pixel art comic

(Source: Marin Balabanov)

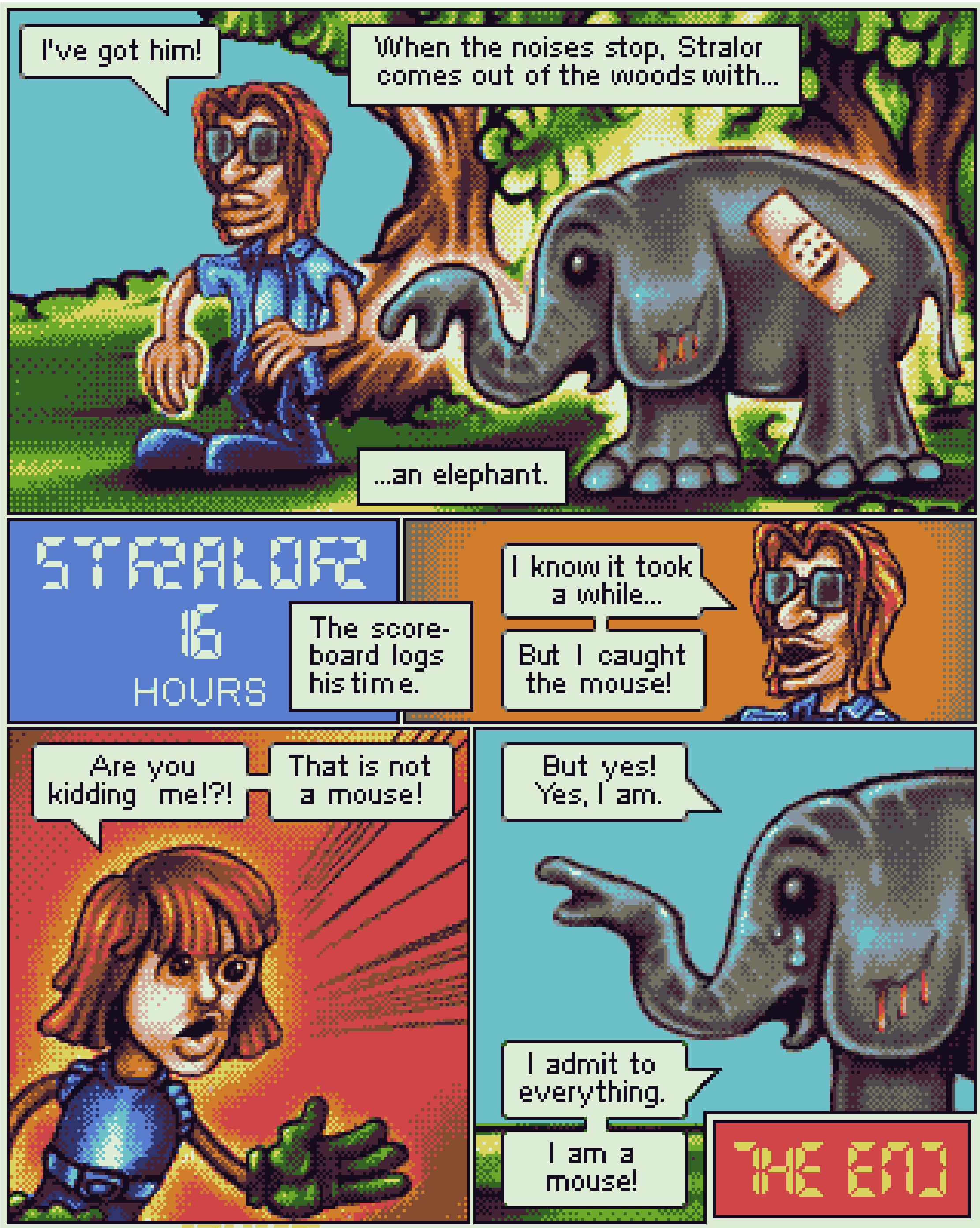


Figure 46: The fifth and last page of the pixel art comic

(Source: Marin Balabanov)

V. Thanks for the Random Access Memories

Project Summary

The long journey to produce a pixel art comic on a decades old computer is now over. If I had set out to prove that it can be done at all, then I would have fallen short, because it had been done before. In the late 1980s, German comic artist Michael Götze already produced three books of his "Robot Imperium" series. One in black and white and the other one in colored format.

The creators of the cyberpunk comic "Splatter" had in the mid-1980s used a similarly capable Macintosh computer to draw the first nine issues of their series.

I had not set out to prove that it can be done at all, but rather, that it can still be done today. The comic is finished, and I am mostly happy with it. There are definitely some areas for improvement. While I still do not think that debating whether this is art, I still would like to use a quote often credited to Paul Varléry or Oscar Wilde: "A work of art is never truly finished, but merely abandoned." I could work on these five pages forever, constantly refining and redrawing them. At some point the project had to find an end and have a final result. You hold this result in your proverbial hands (merely proverbial, because you are most likely reading this on a screen).

Figure 47: The printed result of the pixel art comic project (Source: Marin Balabanov)

Lessons Learned

I barely scratched the surface of the Atari's capabilities. If I would continue making comics this way, I could produce much more refined results and much better comics. Now that I have set up all the hardware and familiarized myself with the production methods, I can experiment with new techniques and aesthetics. While I am really happy with the color palette that I used and am grateful to Dawnbringer for composing such a versatile palette of 16 colors, I most definitely would use something else for a different project.

The same thing goes for NEOChrome, the graphics application. If I would embark on another comic project on the Atari, I might prefer to use another application like Deluxe Paint by Electronic Arts or CrackArt produced in the demo scene.

Another important lesson I learned during this project is to be careful when posting preliminary results to social media. While I was working on the hardware upgrade of the Atari Mega STE, I removed the disk drive and broke open a larger opening to the case's front to accommodate the HxC floppy emulator. I posted a rough cut of my upgrade video in a retro computing group on Facebook. Nearly immediately, I was confronted with criticism that I am mutilating classic hardware, irreversibly disfiguring the case of a computer that is no longer produced.

Figure 48: Holding the finished work in hand (Source: Marin Balabanov)

The Future lies Ahead

When I started working on this project, the pop cultural mainstream was riding high on a 1970s and 1980s nostalgia wave. Shows like "Stranger Things" and movies like "Ready Player One" skillfully appropriated the aesthetics and the story beats of the Steven Spielberg and Stephen King classics from decades long gone, updating them to the sensibilities of today’s viewers. In many cases the viewership was too young to have first-hand experience of the times depicted. Nevertheless, they succumbed to a "second-hand nostalgia."

Even though I am old enough to remember much of the pop culture of the time, I also became enchanted by nostalgia and by retro. By the time I had finished the pixel art comic project, I was totally satiated by the lush landscape of nostalgia and retro memories. While I still passionately love retro hardware, I was fed up by the nostalgic as aspects of the retro scene.

Regardless of any bleak prophecies, I think that the future of technology will be better than the past.