The amazing life & achievements of...

TASBot

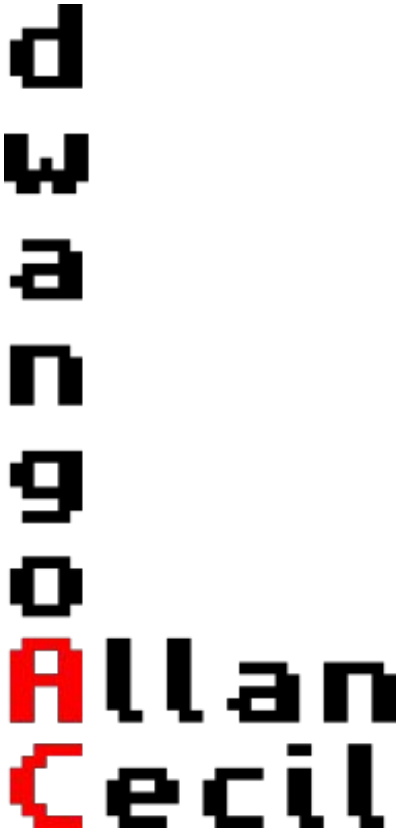
THE PERFECTIONIST

Twitch.tv/dwangoAC @MrTASBot



dwangoAC DEFCON

Presented and written by...



http://acbit.net

Presented and written by...

President of the North Bay Linux Users' Group



NBLUG
North Bay Linux Users' Group

http://nblug.org

dwango

Allan Cecil

http://acbit.net

Presented and written by...

dwagner

President of the North Bay Linux Users' Group

Senior Engineer at ~~Cyan~~ Ciena



http://nblug.org



http://www.ciena.com/

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ciena

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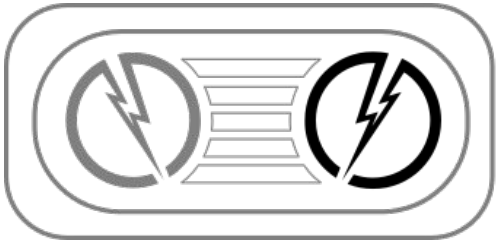
http://tasvideos.org/DwangoAC.html



TASER

http://tasbot.net


TASVideos
SELECT START
B
A

Speedrunning

Human limits



http://speeddemosarchive.com/

Playing games fast

http://speeddemosarchive.com/

Playing games fast

- Inspiration: in-game completion timers





Playing games fast



- Inspiration: in-game completion timers
- Many categories, ranging from "any%" to "low% no major glitches"
- SPEED DEMOS ARCHIVE and others track fastest completion times
- Strict rules + peer review: no cheats, no macros
- Typically highly entertaining



Games Done Quick



Games Done Quick

Speedrunning marathons for charity streamed live on twitch

Classic **GDQ** (2010), **A**wesome **GDQ** (2011-), **S**ummer **GDQ** (2011-)



prevent cancer FOUNDATION

MEDECINS SANS FRONTIERES
DOCTORS WITHOUT BORDERS

https://youtu.be/kIIzE_H7D2g?t=5m27s AGDQ 2014



Abusing games

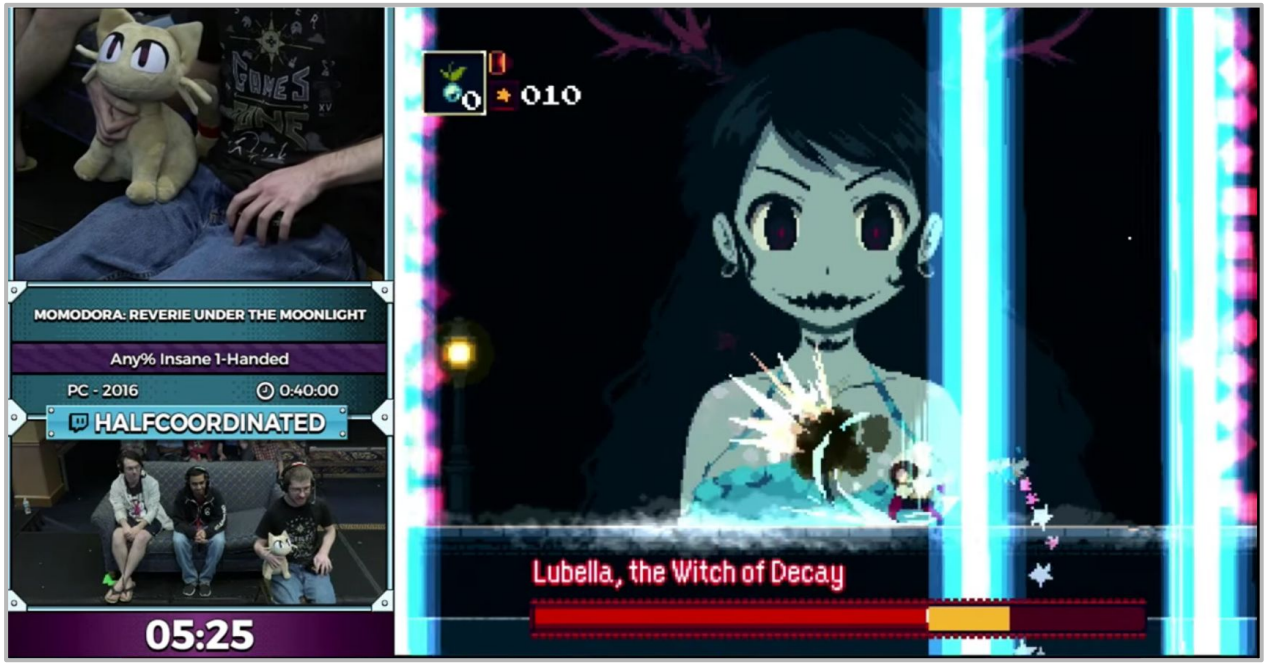
https://youtu.be/kIIzE_H7D2g?t=5m27s AGDQ 2014



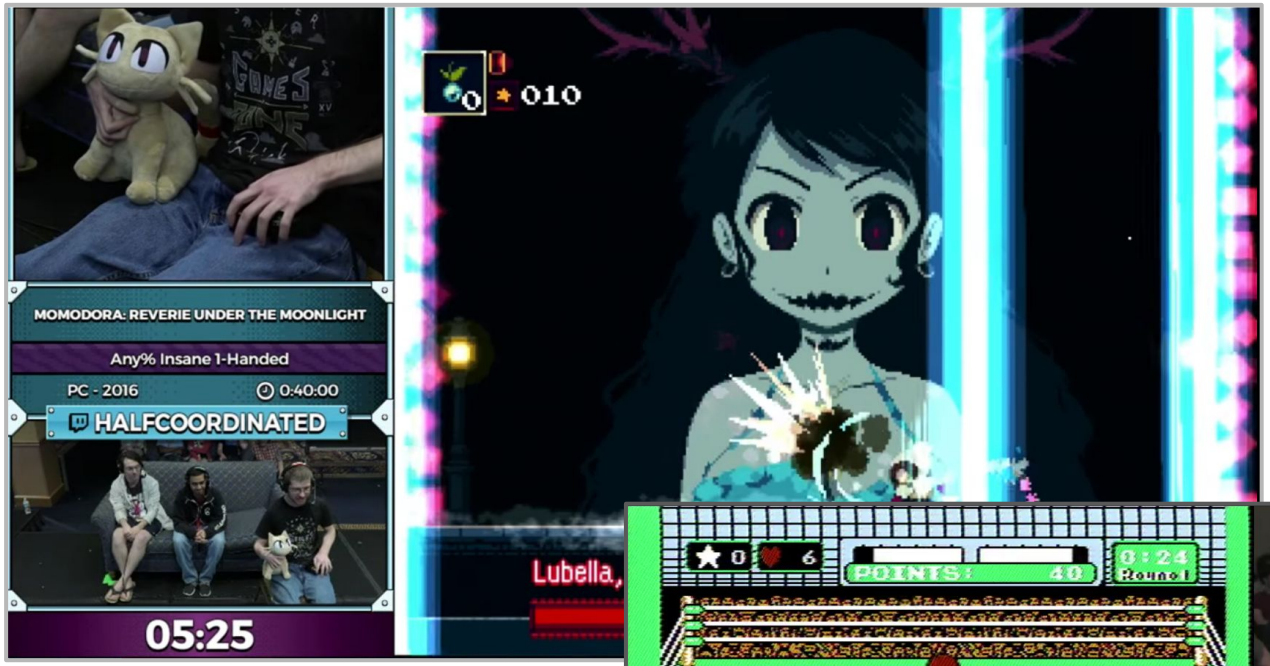


Abusing games

Metroid 15:43 World Record https://www.youtube.com/watch?v=67kQ3l-1qMs



https://www.youtube.com/watch?v=JXtUwIW7cL8
Momodora by Halfcoordinated - SGDQ 2016



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Punch-Out blindfolded by Sinister1 - AGDQ 2014
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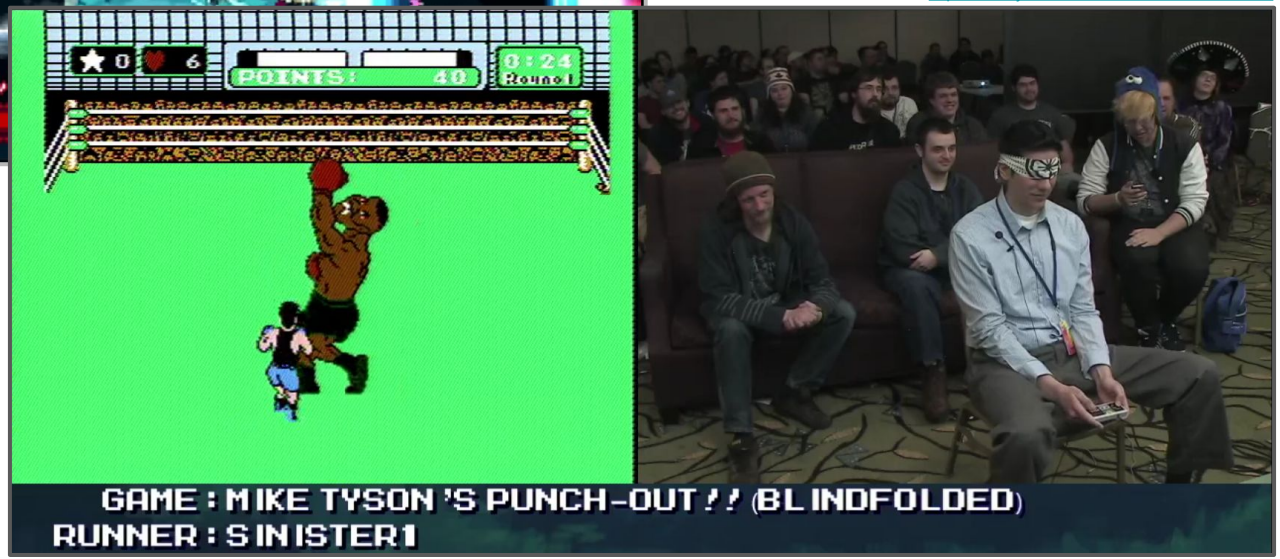

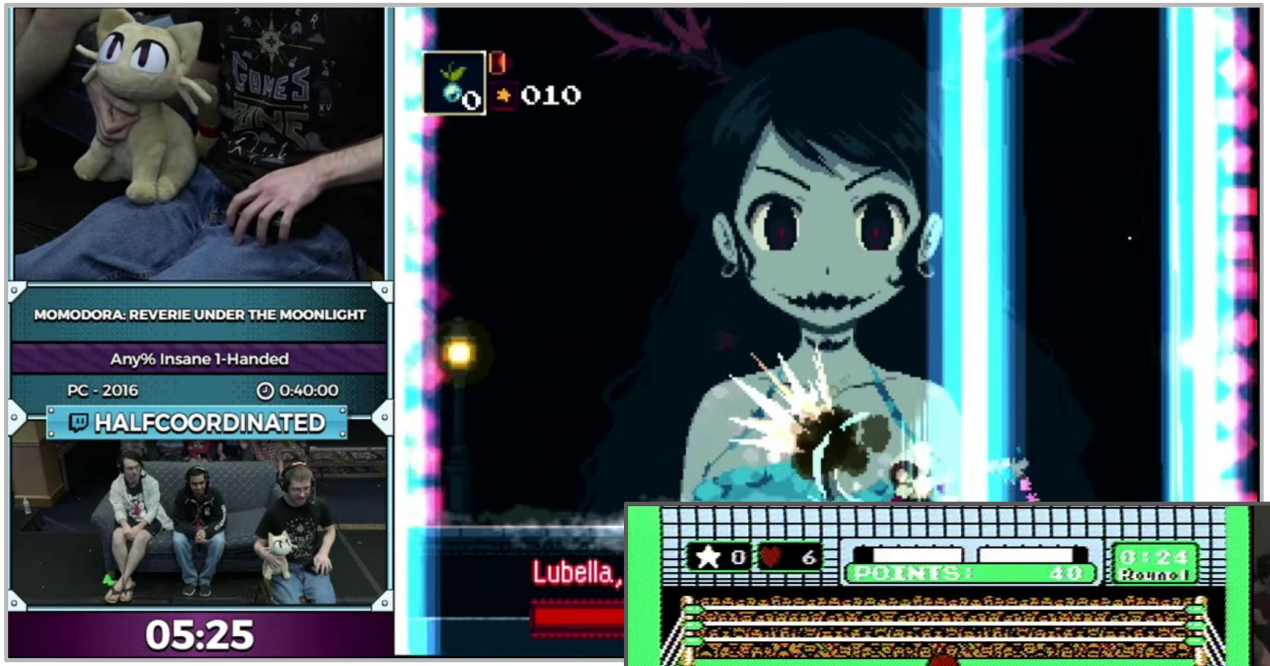

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Beyond standard limits!

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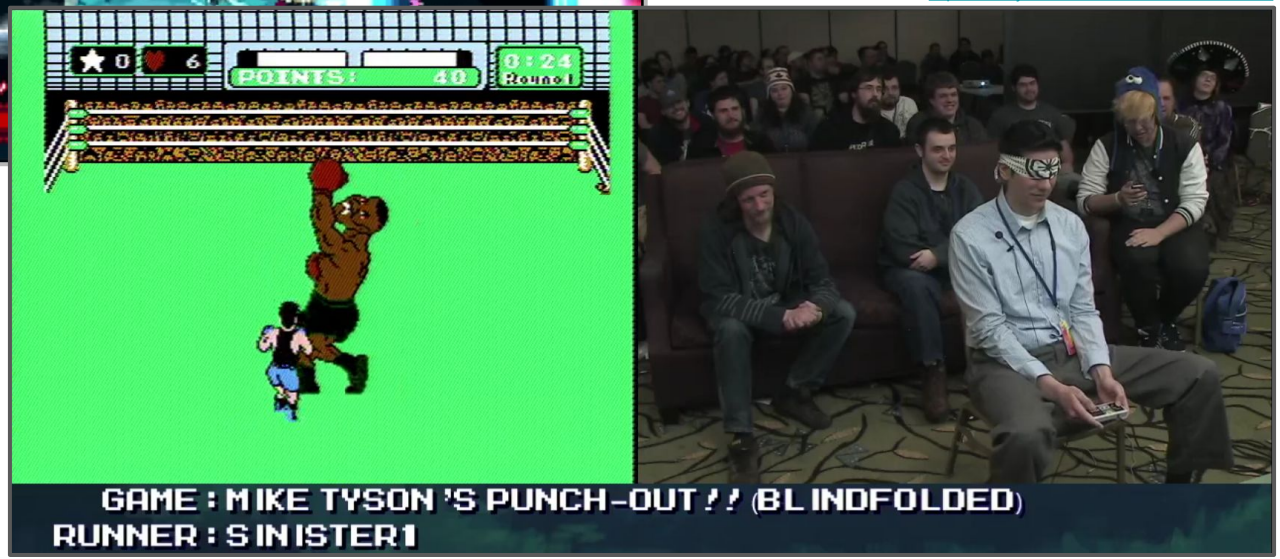

Even 1-handed, blindfolded...


TRS VIDEOS

Tool-**A**ssisted **S**uperplays

Speedruns

From human limits

To hardware limits



Tool-**A**ssisted **S**uperplays

Speedruns

From human limits
To hardware limits



TAS *verb / noun* ~ **TASer** *noun*

"I'm a TASer working on Tetris." / "I'm TASing Tetris."
"I TAS'ed Tetris." / "They made a TAS of Tetris."

Harder Faster Better Stronger

Harder Faster Better Stronger

- Early PC game TAS’s: Savestates, slow motion, and recording tools

Harder Faster Better Stronger

- Early PC game TAS's: Savestates, slow motion, and recording tools
- ~1999: Doom Done Quick in 19:41



2003 SUPER MARIO BROS. 3















https://www.youtube.com/watch?v=BEcrJLM4GgU
http://web.archive.org/web/20031203222907/http://soramimi.egoism.jp/emu.htm

2003 SUPER MARIO BROS. 3

CONTROVERSIAL















https://www.youtube.com/watch?v=BEcrJLM4GgU
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Inhuman skill on display

- Tools meant hardware limits became the **only** limits

http://tasvideos.org/WelcomeToTASVideos.html
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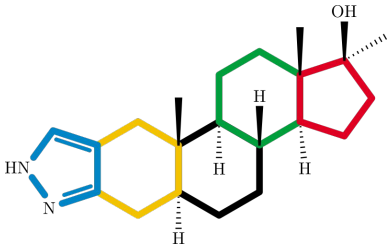
- Tools meant hardware limits became the **only** limits
- TASing looked like the Doped Olympics
  - Competitors should admit to doping
  - Videos made with TAS tools should be labeled



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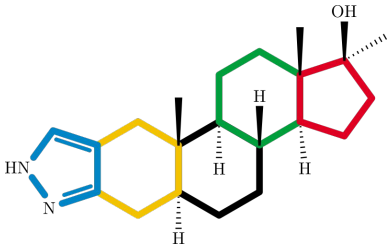

- NESVideos created by Bisqwit in 2004



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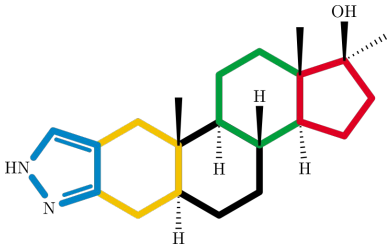
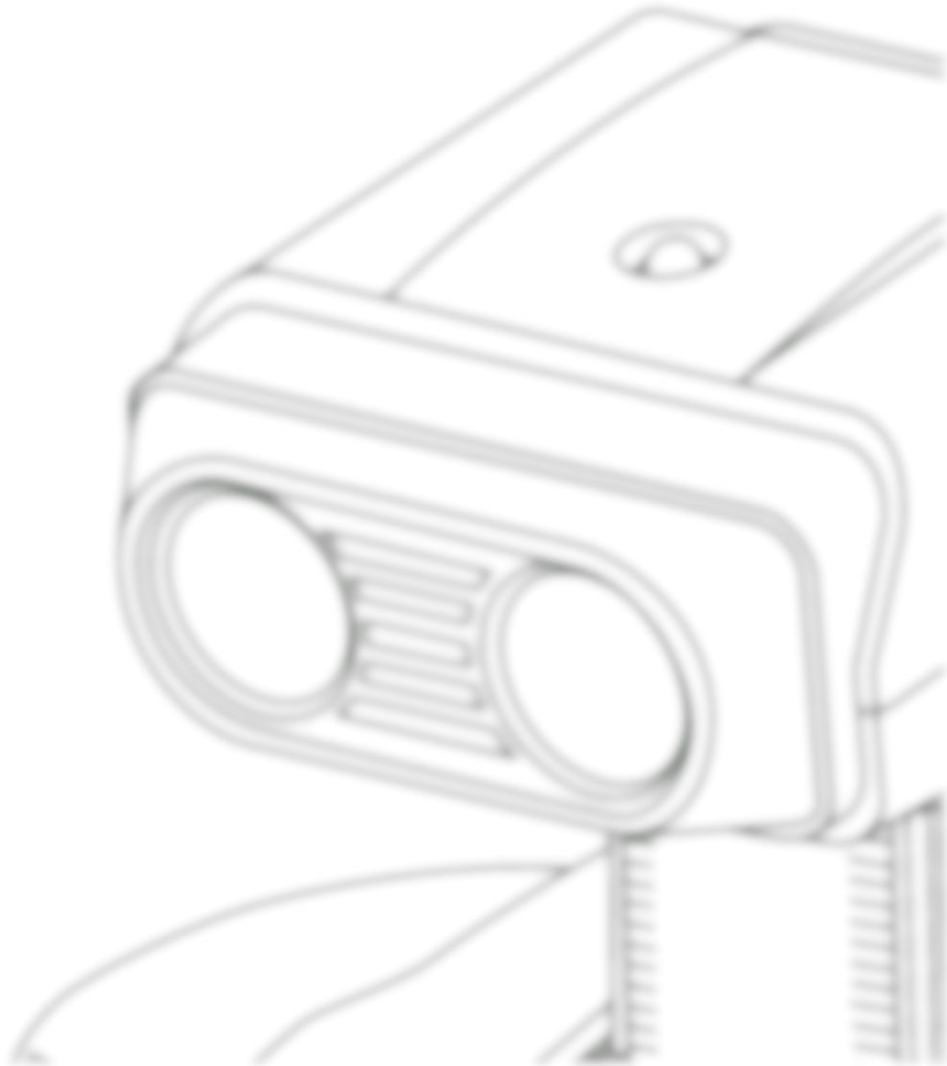


- NESVideos created by Bisqwit in 2004
  - Now at TASVideos.org with runs for many platforms

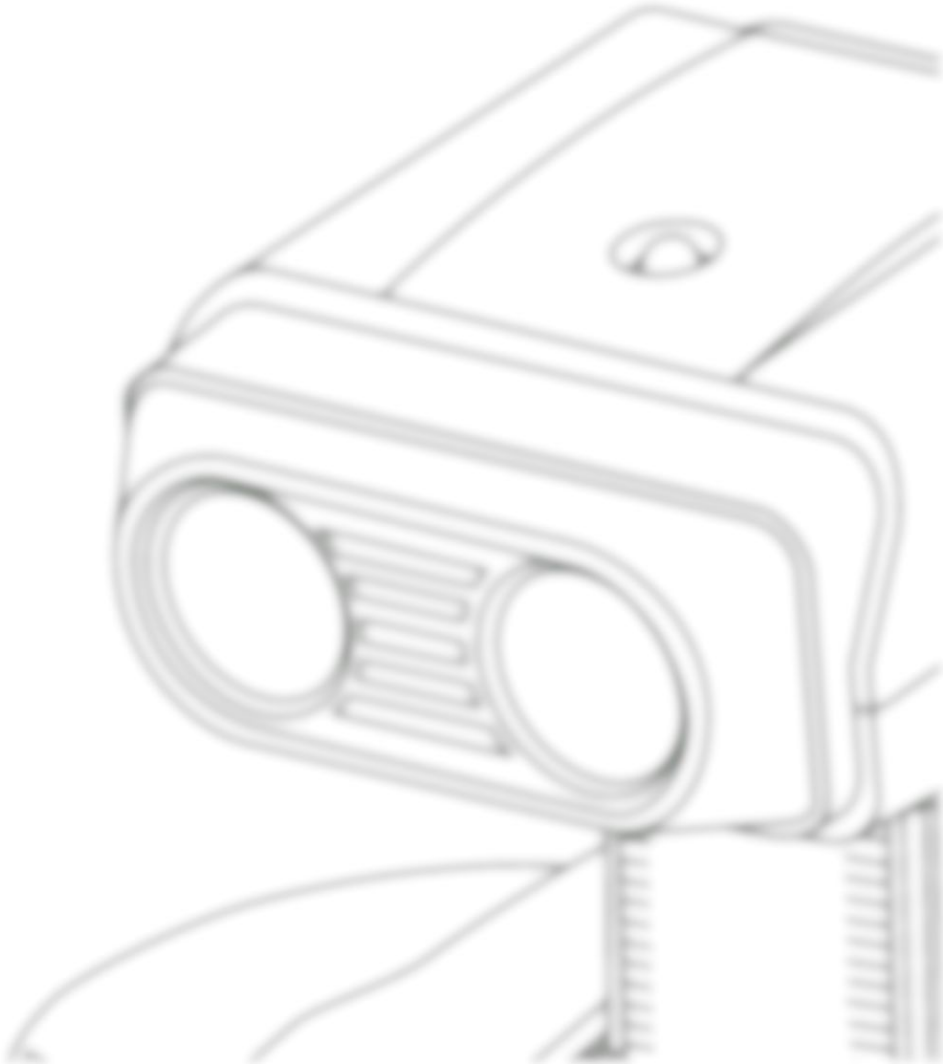
Nesvideos
Tool-assisted speedruns

http://tasvideos.org/WelcomeToTASVideos.html
https://web.archive.org/web/20060511210906/http://bisqwit.iki.fi/nesvideos/



Console verified

Pushing hardware limits



Console verified

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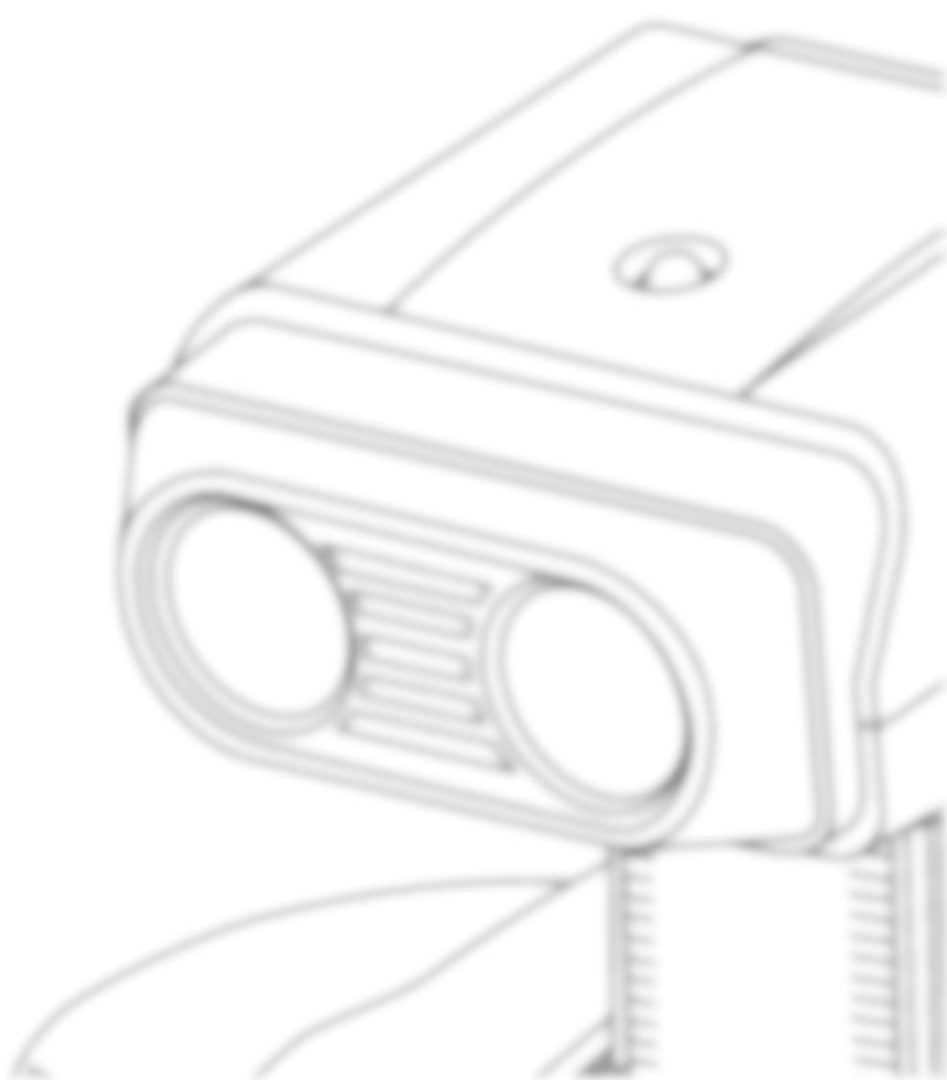
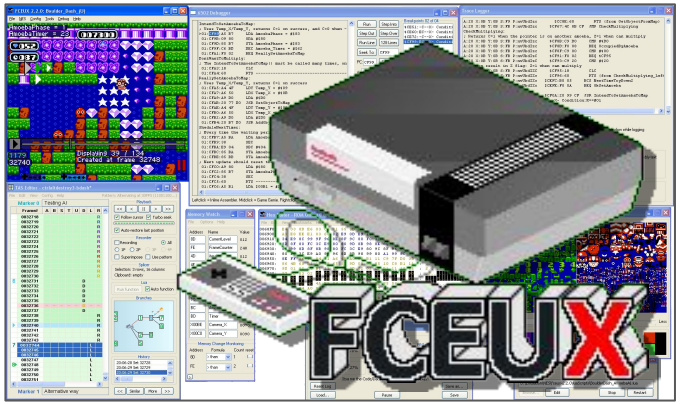
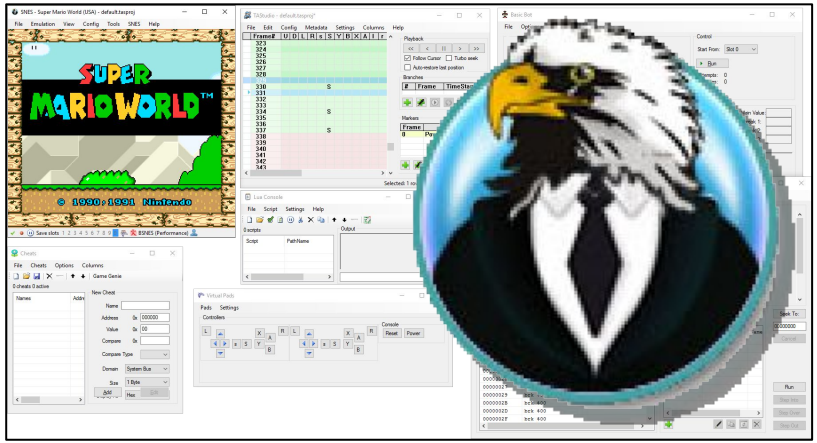


Console emulators

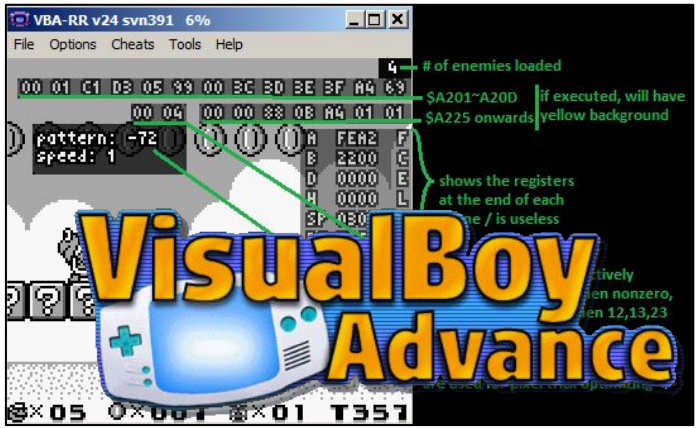
http://tasvideos.org/Lsnes.html lsnes





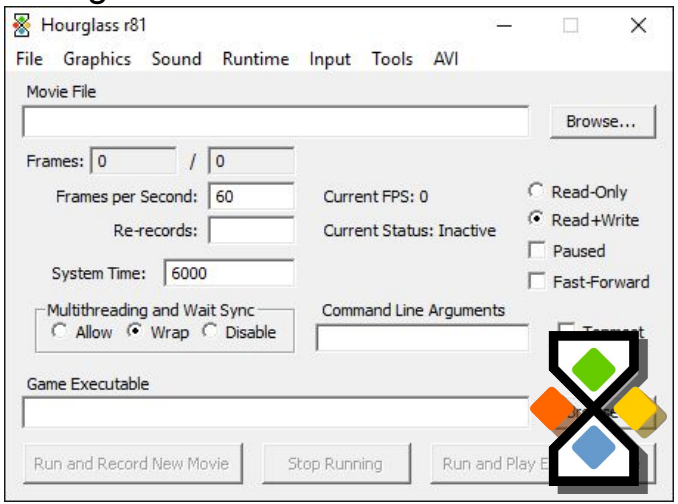


BizHawk http://tasvideos.org/BizHawk.html



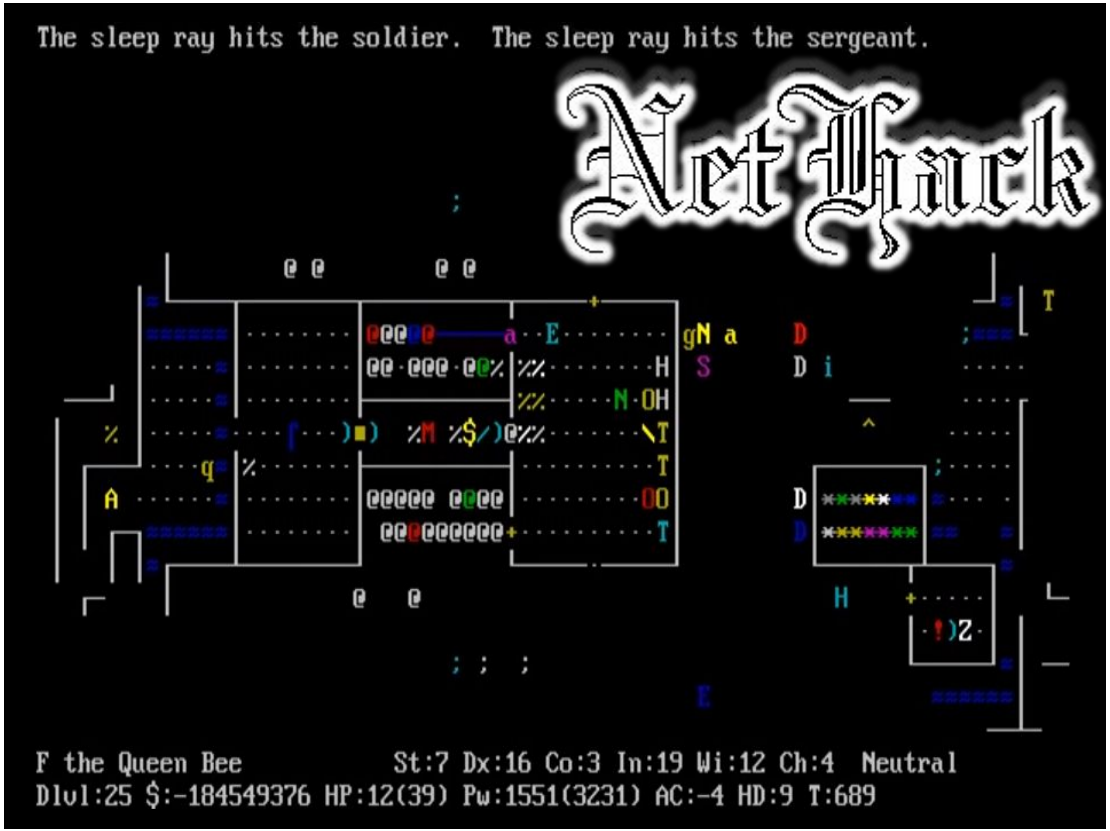
Rerecording frameworks

Hourglass



http://tasvideos.org/EmulatorResources/Hourglass.html

NetHack specific tools



http://tasvideos.org/GameResources/DOS/Nethack.html

Emulation accuracy evolution

Emulation accuracy evolution

- Early emulators: highly inaccurate
- Clean room reverse engineering
  - or stolen manuals

http://arstechnica.com/gaming/2011/08/accuracy-takes-power-one-mans-3ghz-quest-to-build-a-perfect-snes-emulator/
https://web.archive.org/web/20120915125144/http://byuu.org/bsnes/accuracy

Emulation accuracy evolution

- Early emulators: highly inaccurate
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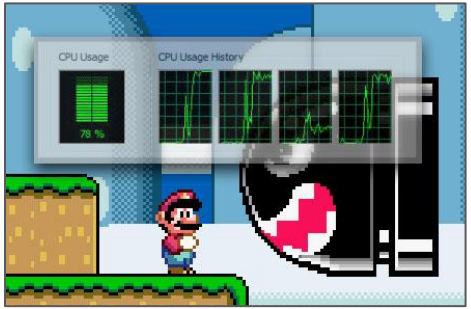
- *bsnes*: extreme accuracy, poor usability



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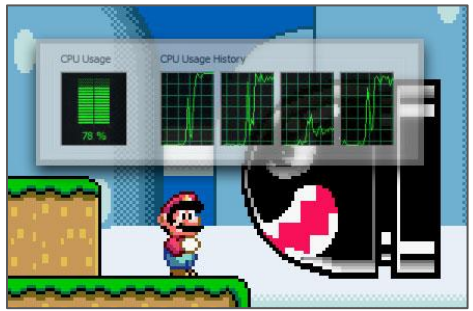

http://byuu.org/emulation/higan/

http://arstechnica.com/gaming/2011/08/accuracy-takes-power-one-mans-3ghz-quest-to-build-a-perfect-snes-emulator/
https://web.archive.org/web/20120915125144/http://byuu.org/bsnes/accuracy

Emulation accuracy evolution

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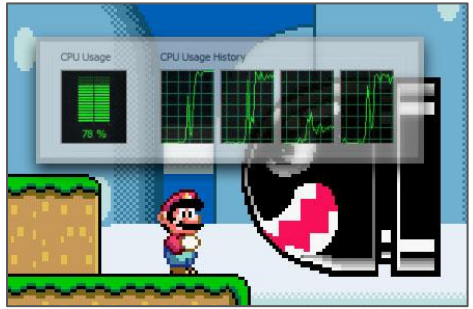
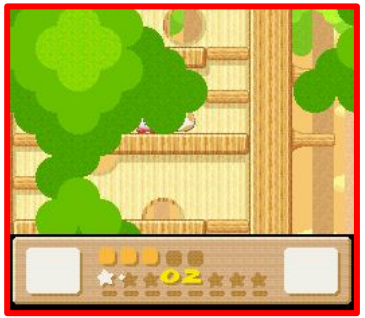
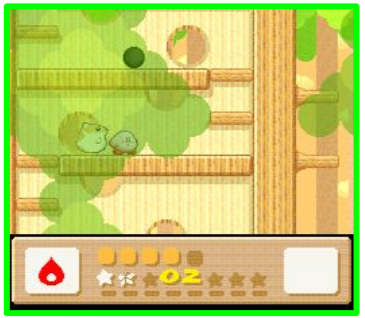
- *higan*: extreme accuracy, poor usability

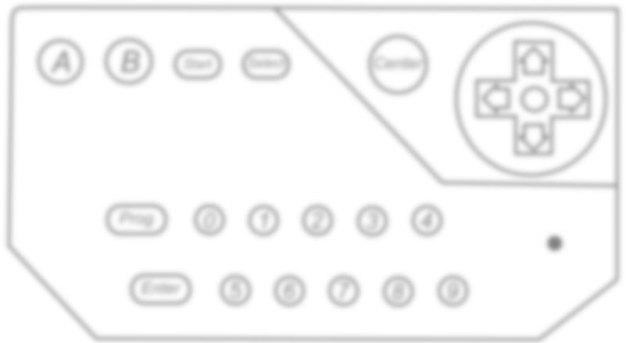
⇒ match actual hardware, frame for frame







http://byuu.org/emulation/higan/


A
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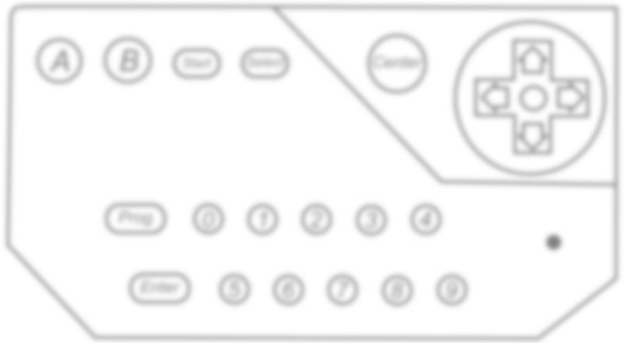
Memory searching, Lua scripting, disassembly



https://www.lua.org/



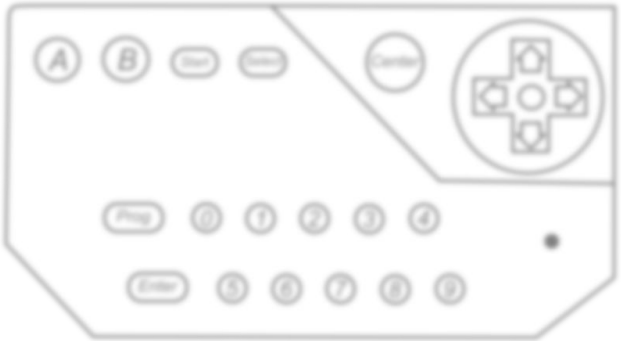
Memory searching, Lua scripting, disassembly

- More than just frame advance and savestates

https://www.lua.org/



https://www.youtube.com/watch?v=RtaS4KEl4Qc



Memory searching, Lua scripting, disassembly



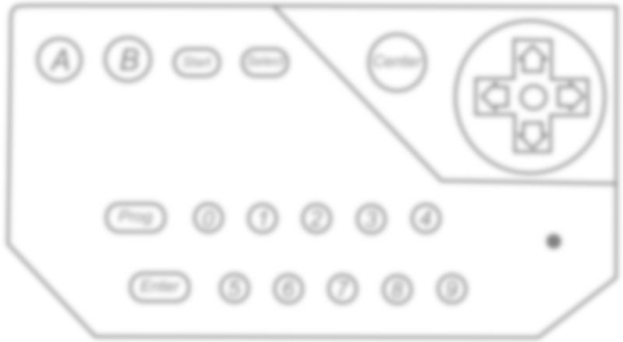
https://www.lua.org/

- More than just frame advance and savestates
- Find a specific value: save, reset memory search, run
  - Search based on conditions, repeat



https://www.youtube.com/watch?v=RtaS4KEl4Qc





Memory searching, Lua scripting, disassembly



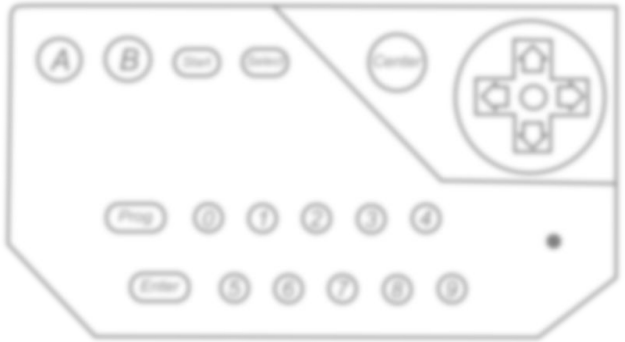
https://www.lua.org/

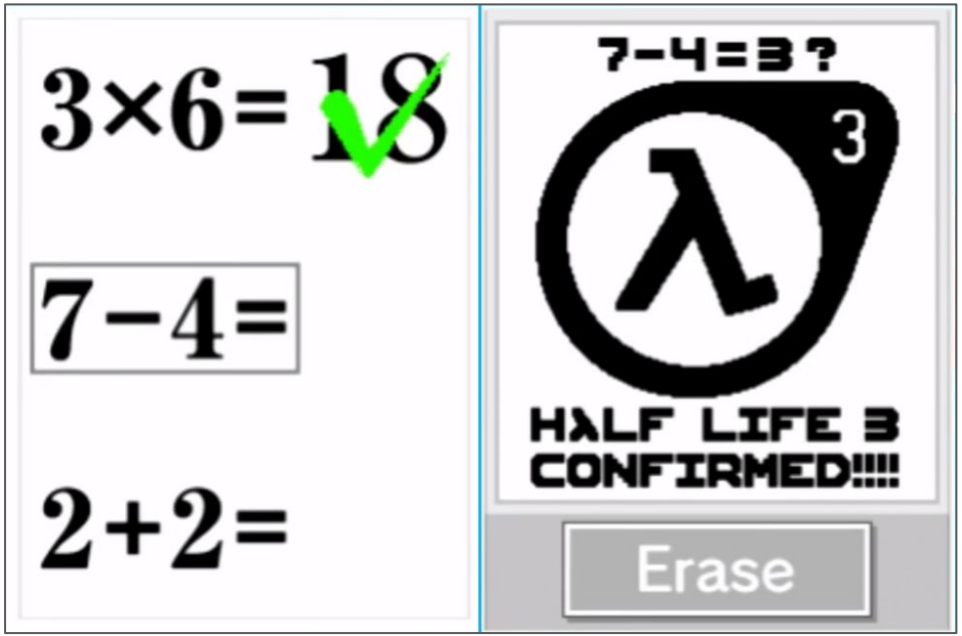
- More than just frame advance and savestates
- Find a specific value: save, reset memory search, run
  - Search based on conditions, repeat
- Disassembly of RAM or ROM for complete understanding



https://www.youtube.com/watch?v=RtaS4KEl4Qc



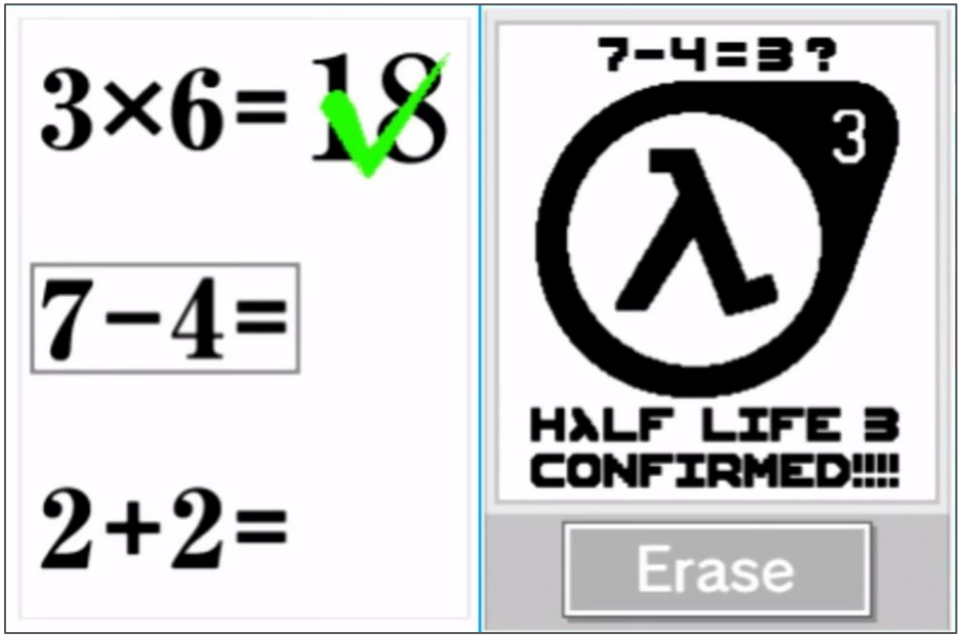




Abusing handwriting recognition

https://youtu.be/mSFHKAvTGNk?t=29m53s AGDQ 2016

Abusing handwriting recognition



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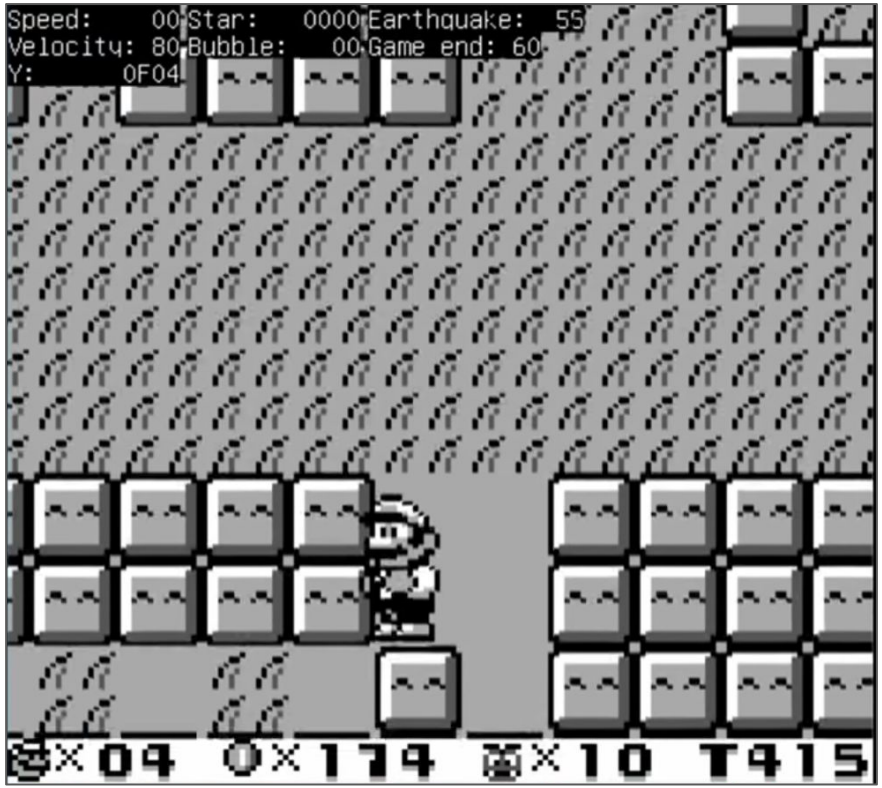
SGDQ 2016 https://youtu.be/EHfw-BEuRO8?t=12m28s



Editing memory live directly in the game


POWER GLOVE

TAS ⇔ Infosec equivalents

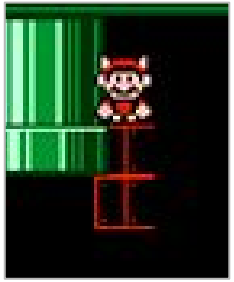
- Savestate = VM snapshot
- Frame advance = VM CPU step / tick
- Glitch = Vulnerability
- Arbitrary Code Execution = Exploit
- Console verification = Evil maid attack

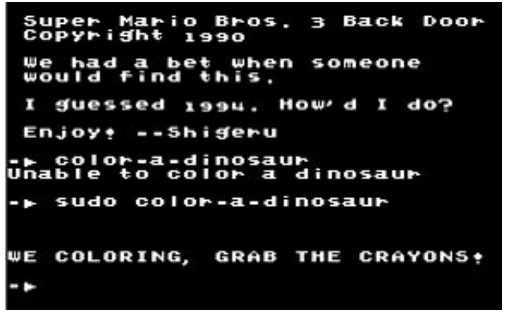
⇒ TAS = fun, technical, educational

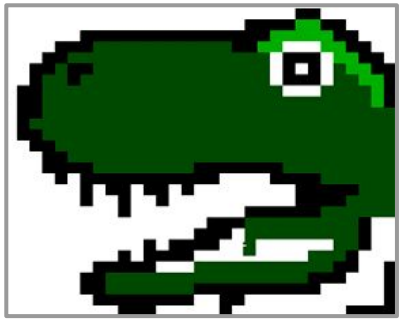


AGDQ 2016 https://youtu.be/pj7RE2DcRgc?t=50m23s

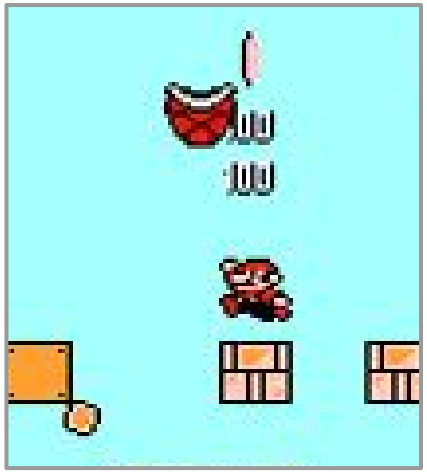
SMB3 Total Control Glitchfest by Lord Tom















TASBot

TASBot

plays

TASBot

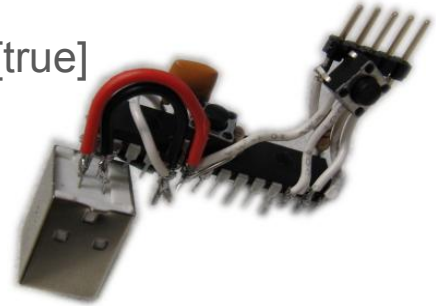
plays



Early console verification devices

Early console verification devices

- **2009**
  - a PIC to press NES buttons [true]



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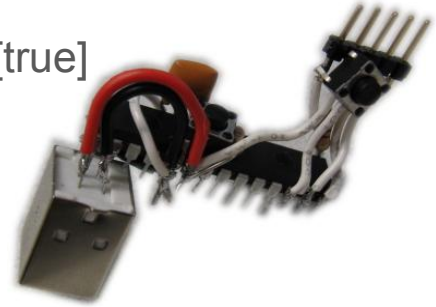
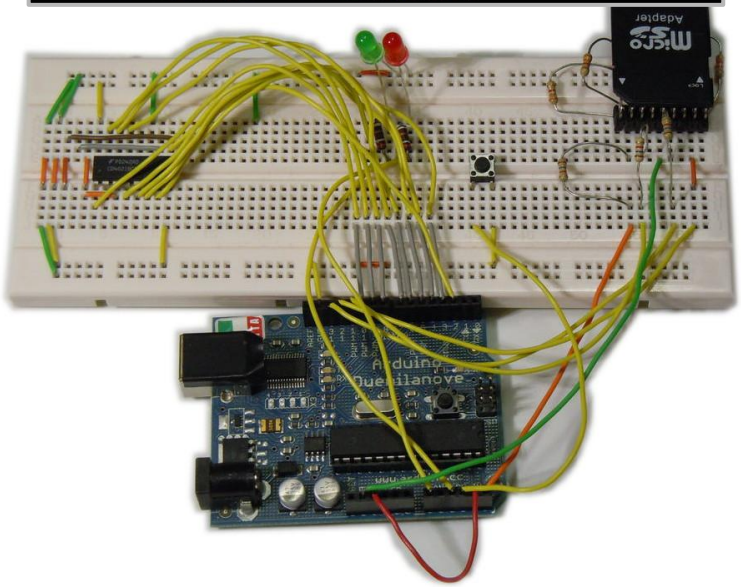


- **2011**
  - NESBot [micro500]: first replay of SMB1
    - Used at SGDQ 2011 on SMB2 and W&W 3

https://www.youtube.com/watch?v=KQXVgMKJEDY





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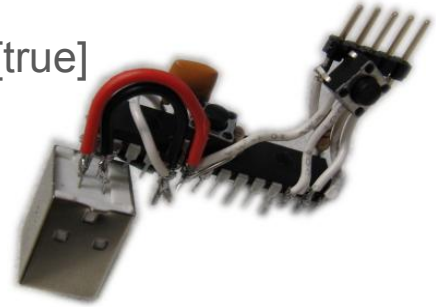

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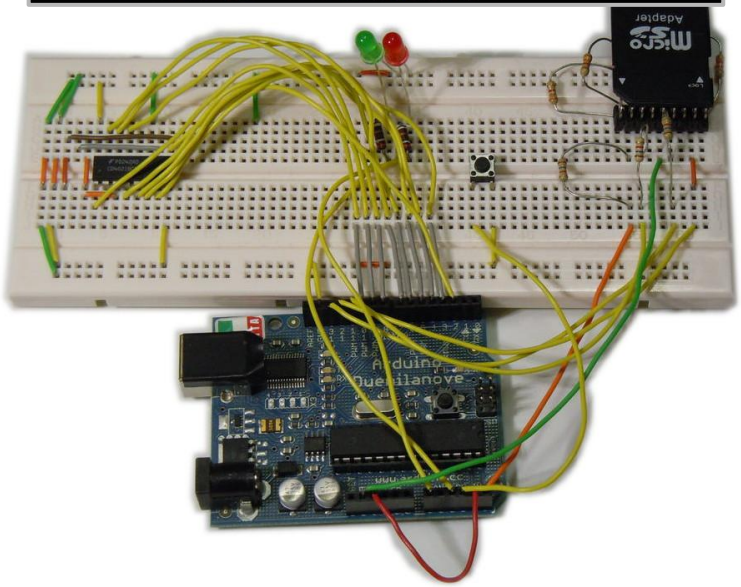
  - NESBot [micro500]: first replay of SMB1
    - Used at SGDQ 2011 on SMB2 and W&W 3
  - Droid64 [SoulCal]
- **2012**
  - N64 [micro500]

https://www.youtube.com/watch?v=KQXVgMKJEDY





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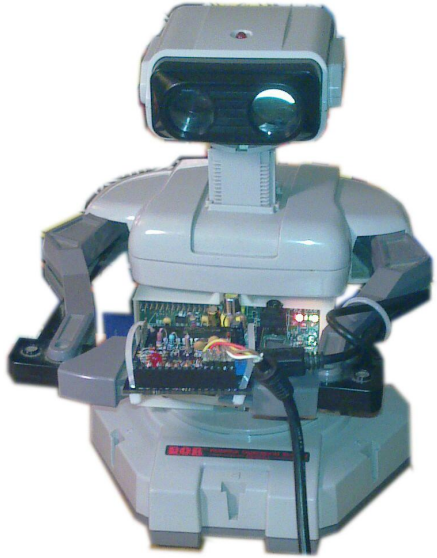
  - NES/SNES replay device [true]
    - Streaming capable and inexpensive but limited datarates

The birth of TASBot



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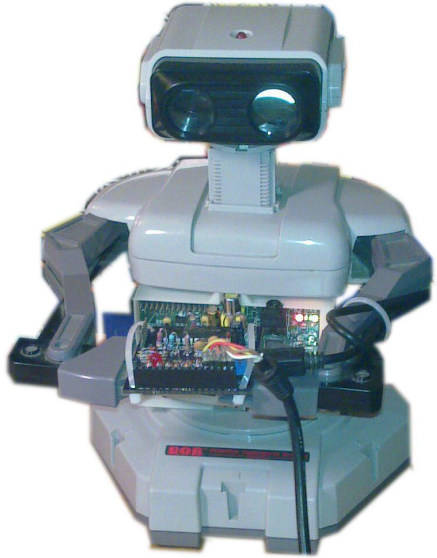

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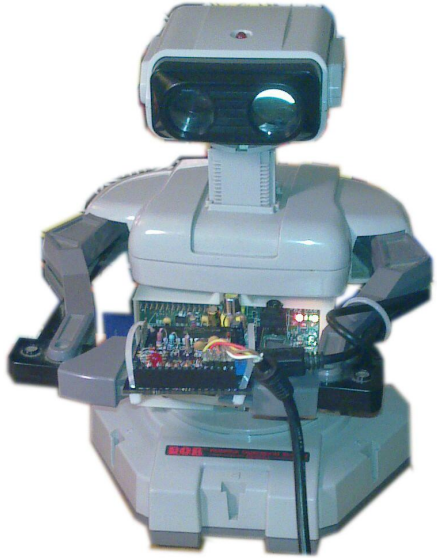
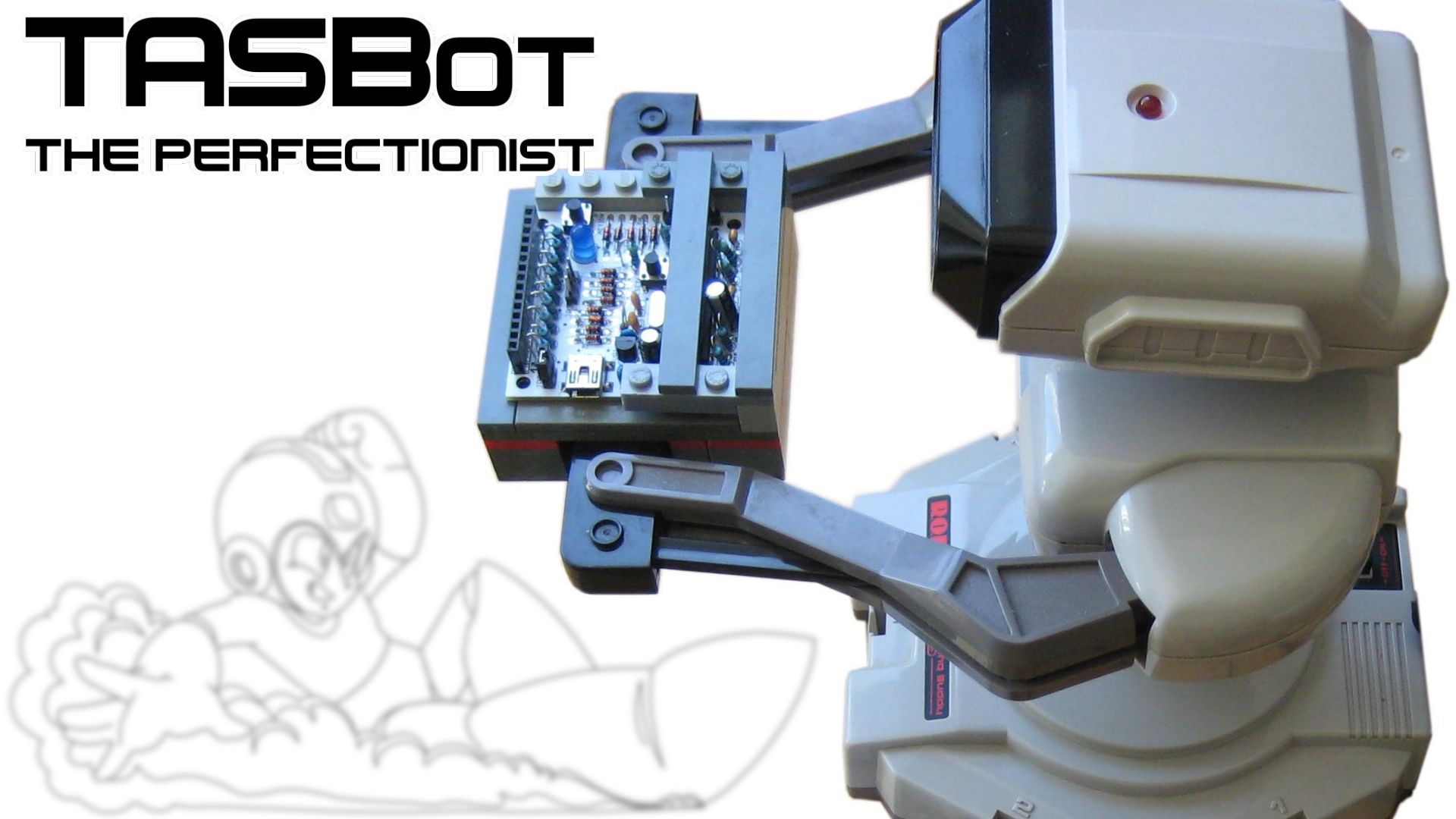




TASBot

THE PERFECTIONIST



TASBot

TASBot

plays

TASBot

plays



TASBot

plays



in



TASBot

plays



in



SMB in SMW by p4plus2 and Masterjun

TASBot plays the SNES classic...

http://arstechnica.com/gaming/2015/01/pokemon-plays-twitch-how-a-robot-got-irc-running-on-an-unmodified-snes/
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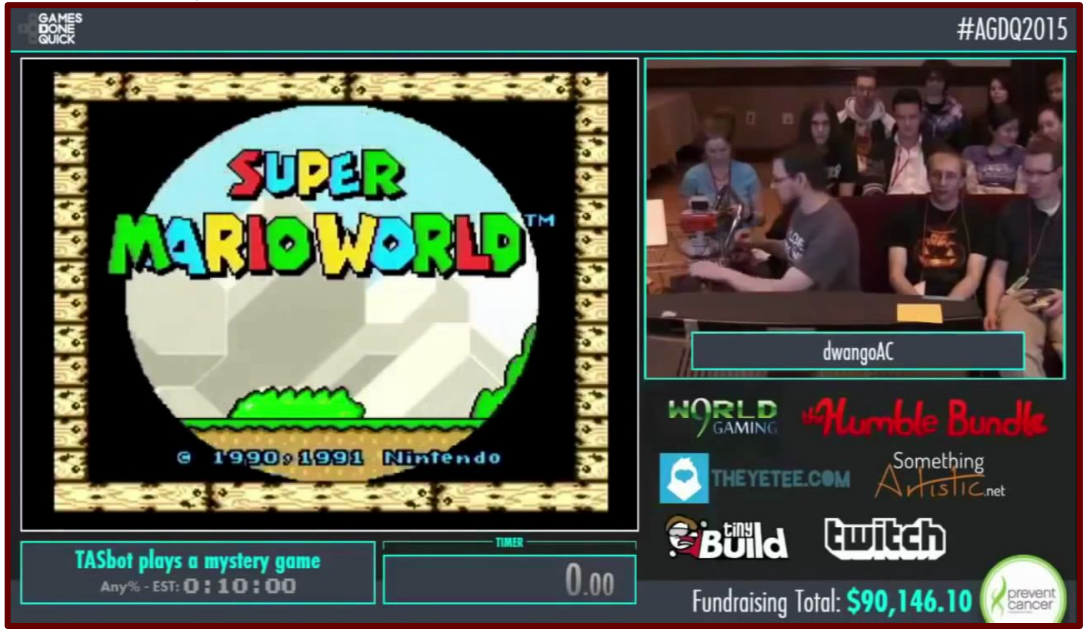
credits: p4plus2, Masterjun



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Exploits it via input...

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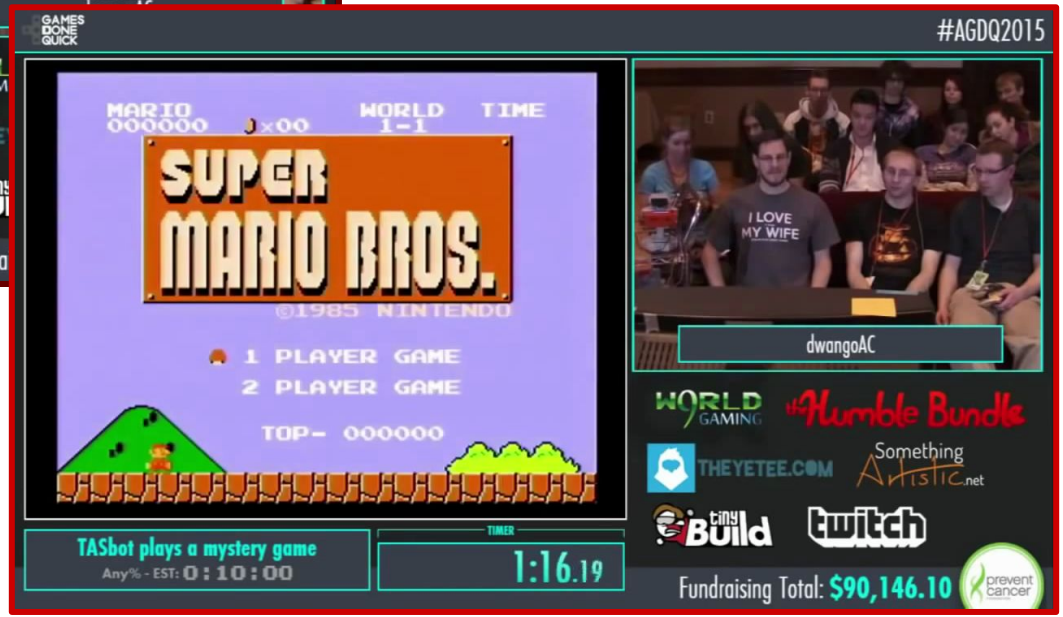

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A 8-bit game, on a 16-bit system!





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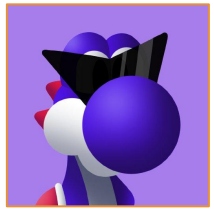
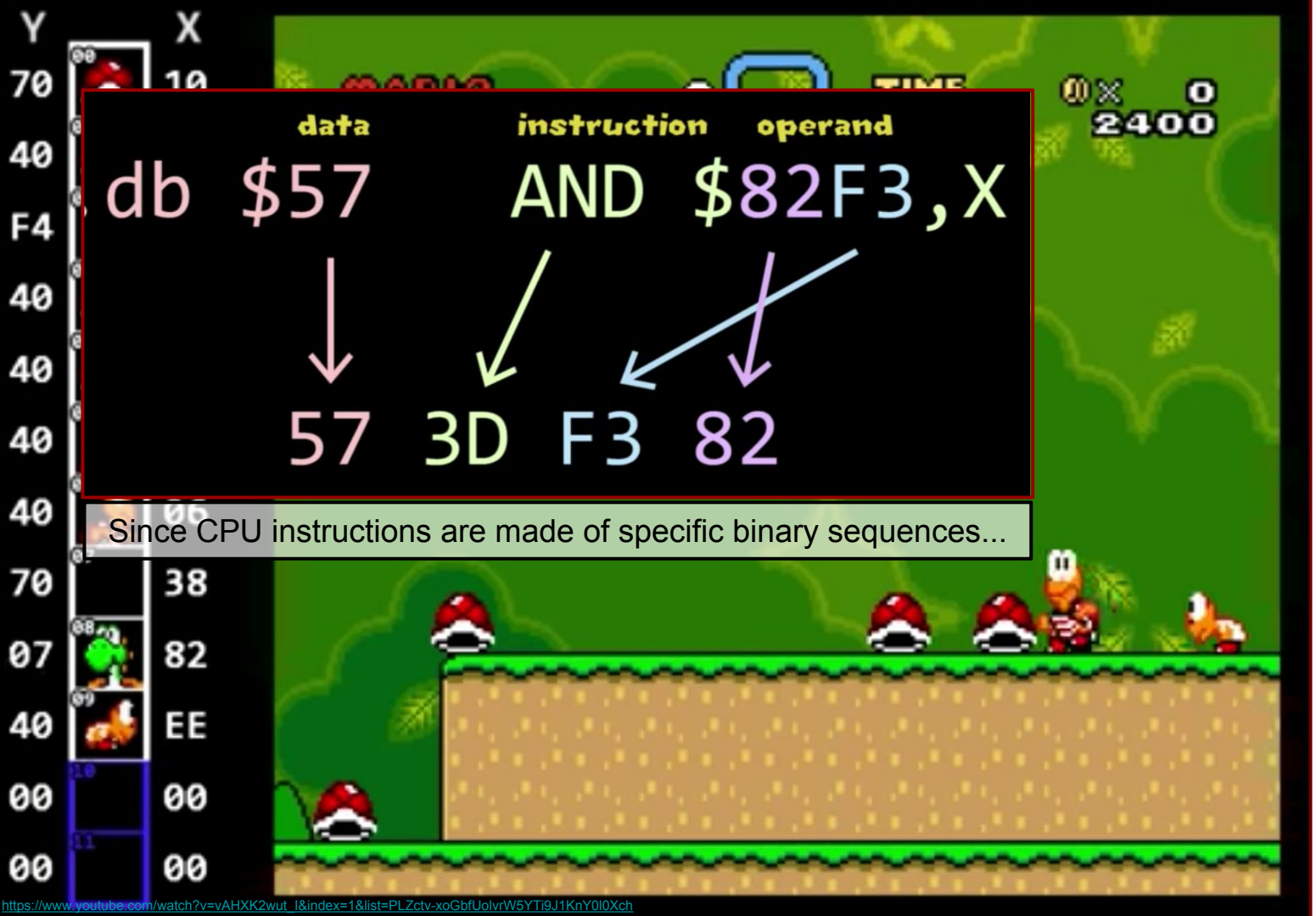
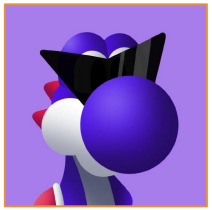


dotsarecool

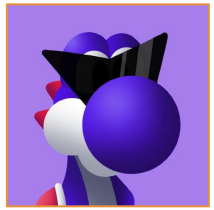
https://www.youtube.com/watch?v=vAHXK2wut_I&index=1&list=PLZctv-xoGbfUolvrW5YTi9J1KnY0l0Xch





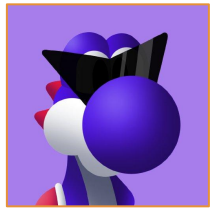
dotsarecool





dotsarecool





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https://www.youtube.com/watch?v=vAHXK2wut_I&index=1&list=PLZctv-xoGbfUolvrW5YTi9J1KnY0l0Xch


dotsarecool
data
instruction
operand
Main Memory
PC = 0100E0
17
4A
CC
F3
Stack
X = 09
...we can
So, just via input...
...you can directly trigger the credits sequence!
MARIO
TIME
249
2400
https://www.youtube.com/watch?v=vAHXK2wut_I&index=1&list=PLZctv-xoGbfUolvrW5YTi9J1KnY0l0Xch

TASLink

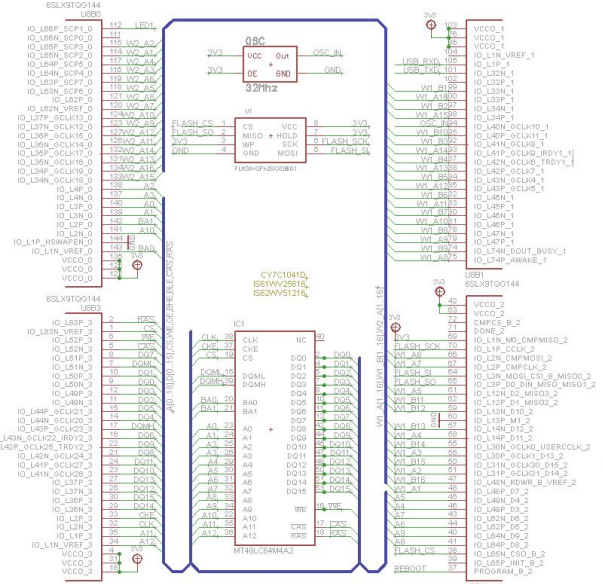


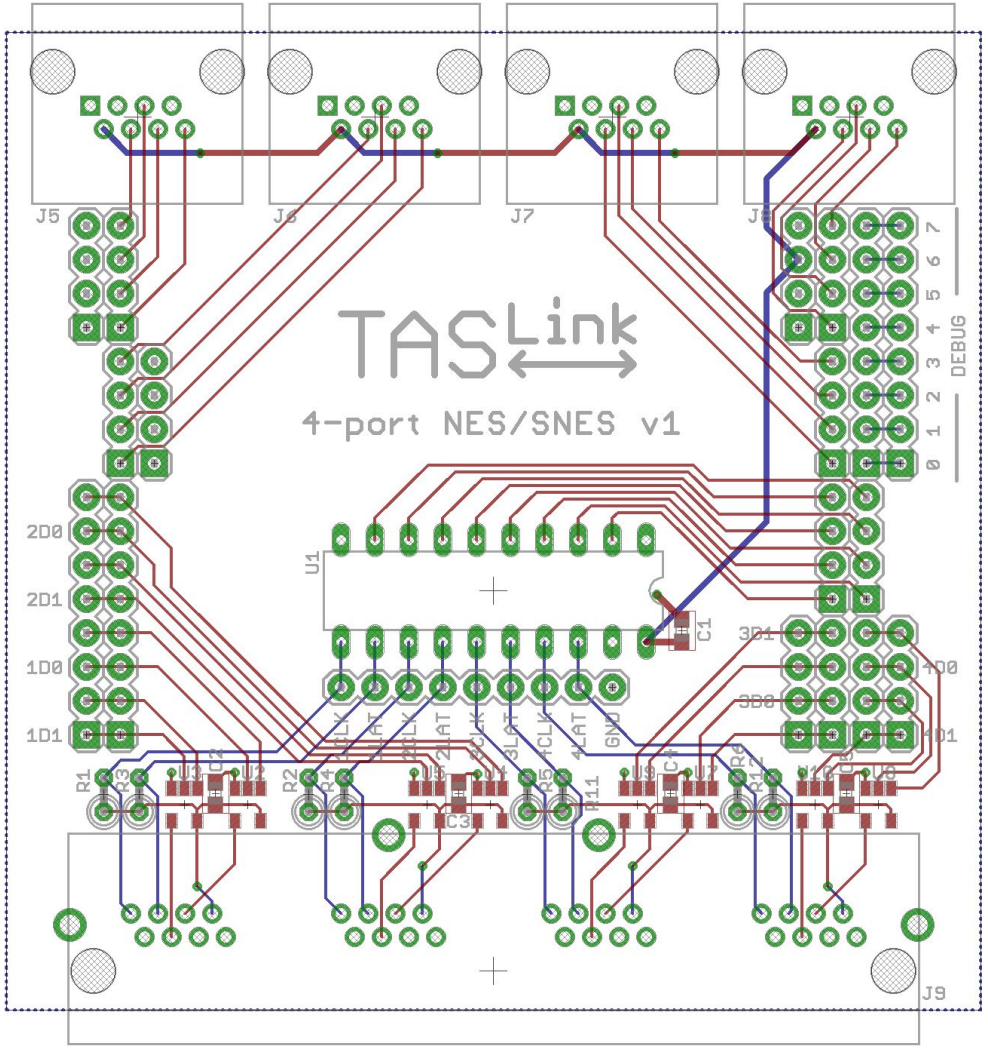
~184 Kbps
was ***too*** limiting

32Mhz FPGA

Papilio Pro's Spartan 6 LX

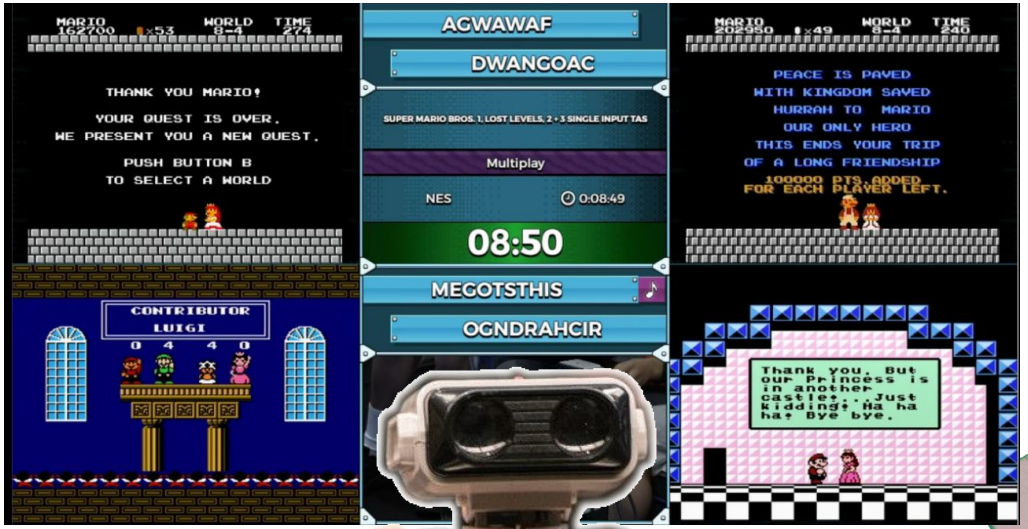
max poll rate of the serial port (2Mb/s)





http://papilio.gadgetfactory.net/index.php?n=Papilio.PapilioPro

SMB1+2+3+Lost Levels played simultaneously during SGDQ 2016



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Anatomy of an Arbitrary Code Execution

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Pokemon Red



1. Input exploit

Anatomy of an Arbitrary Code Execution

Pokemon Red

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2. Take over
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4. Anything is possible




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Pokemon Plays Twitch Credits:
dwangoAC: Main project organizer
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Stage 0/1 movie files, PR
Ilari: Emulator coder (lsnes),
Stages 3-5 developer, payload
tester, game mechanic researcher
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Full article in next PocIIGTFO!
Chat
2015
RUNNER
TAS Bot
GAME BOY

TASVIDEOS


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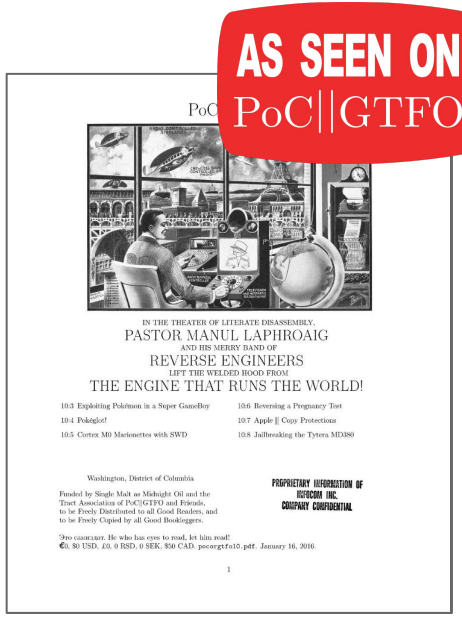
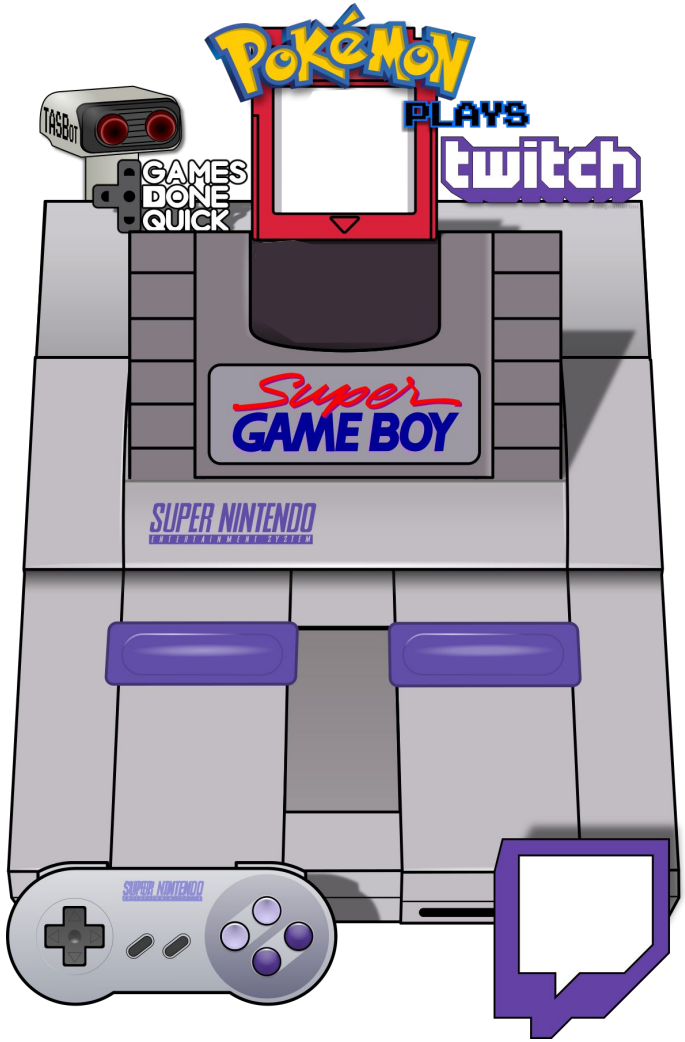

AS SEEN ON
PoC||GTFO
PoC
IN THE THEATER OF LITERATE DISASSEMBLY,
PASTOR MANUL LAPHROAIG
AND HIS MERRY BAND OF
REVERSE ENGINEERS
LIFT THE WELDED HOOD FROM
THE ENGINE THAT RUNS THE WORLD!
10:3 Exploiting Pokémon in a Super GameBoy
10:4 Pokéglot!
10:5 Cortex M0 Marionettes with SWD
10:6 Reversing a Pregnancy Test
10:7 Apple][Copy Protections
10:8 Jailbreaking the Tytera MD380
Washington, District of Columbia
Funded by Single Malt as Midnight Oil and the
Tract Association of PoC||GTFO and Friends,
to be Freely Distributed to all Good Readers, and
to be Freely Copied by all Good Bootleggers.
PROPRIETARY INFORMATION OF
INTECOM INC.
COMPANY CONFIDENTIAL
Pro casuarum. He who has eyes to read, let him read!
€0, $0 USD, £0, 0 RSD, 0 SEK, $50 CAD. pocorgtfo10.pdf, January 16, 2016.
1

TASVIDEOS



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http://arstechnica.com/gaming/2015/01/pokemon-plays-twitch-how-a-robot-got-irc-running-on-an-unmodified-snes/

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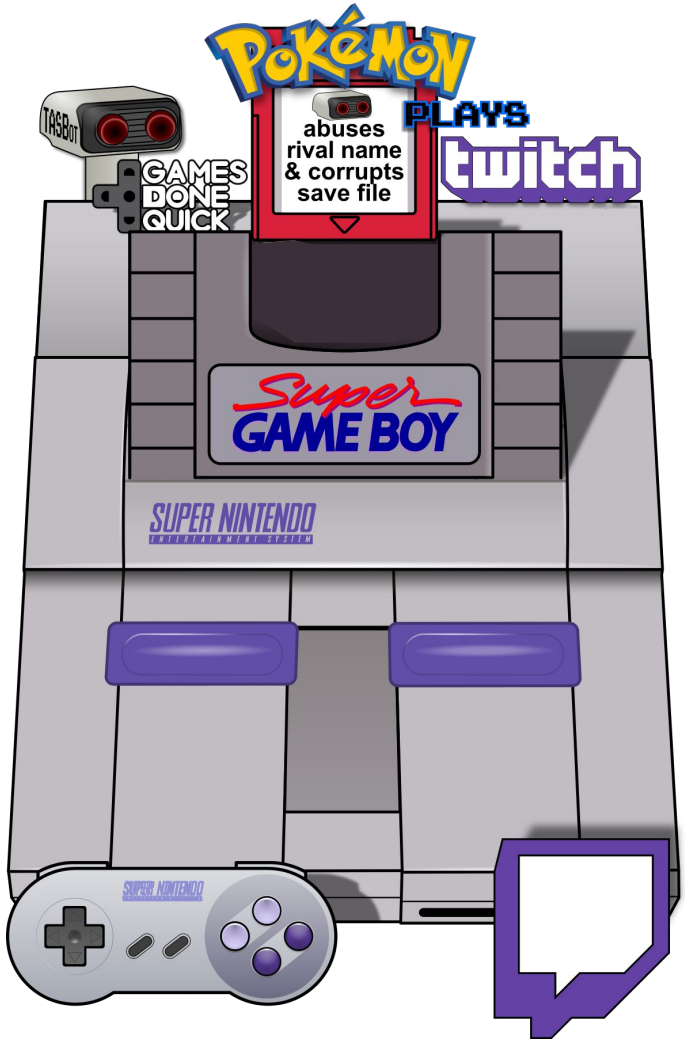



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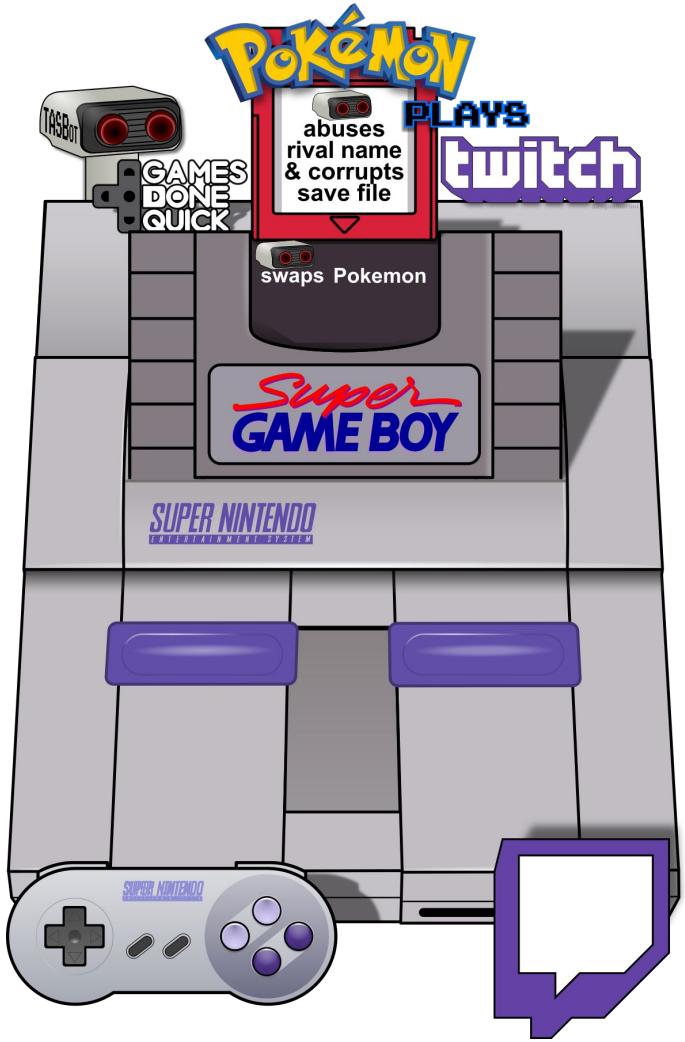



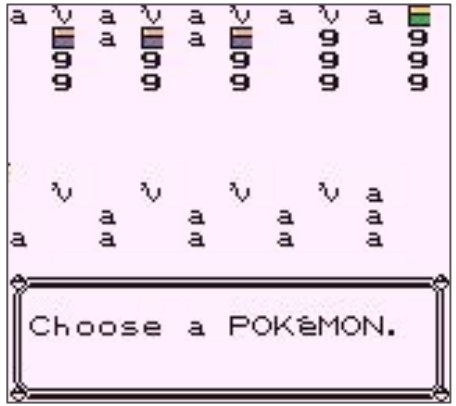

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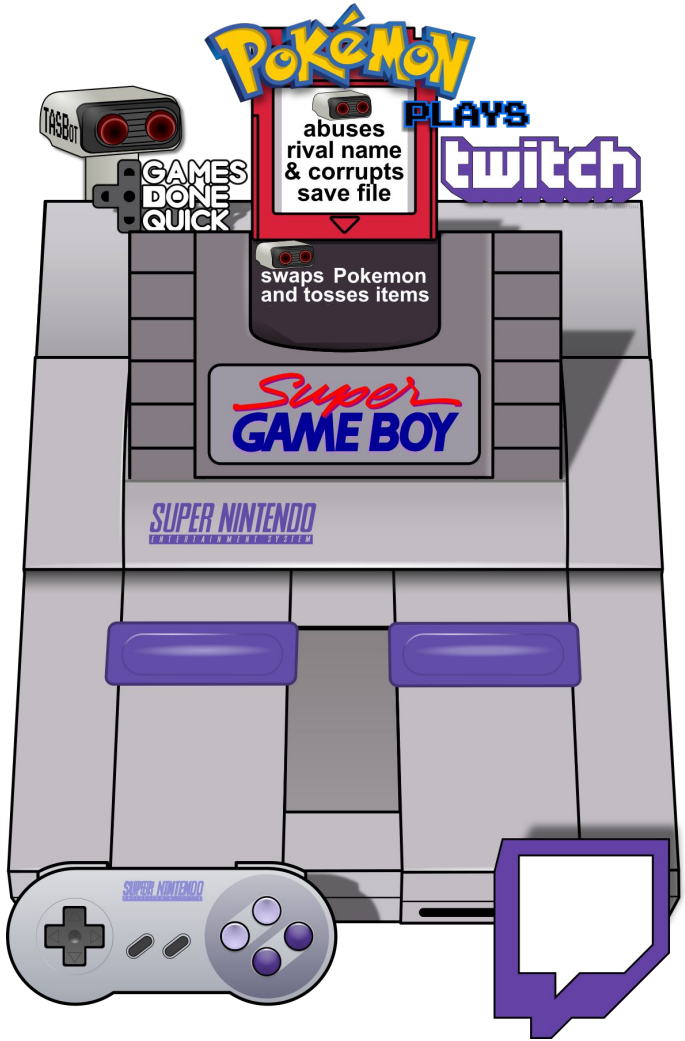



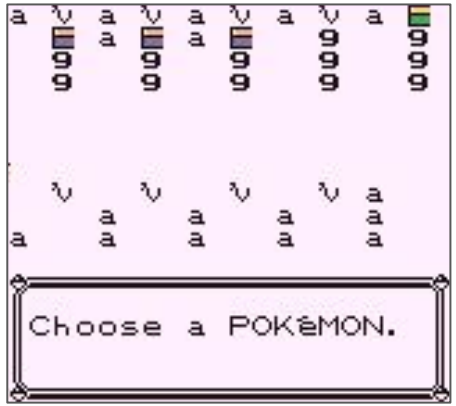



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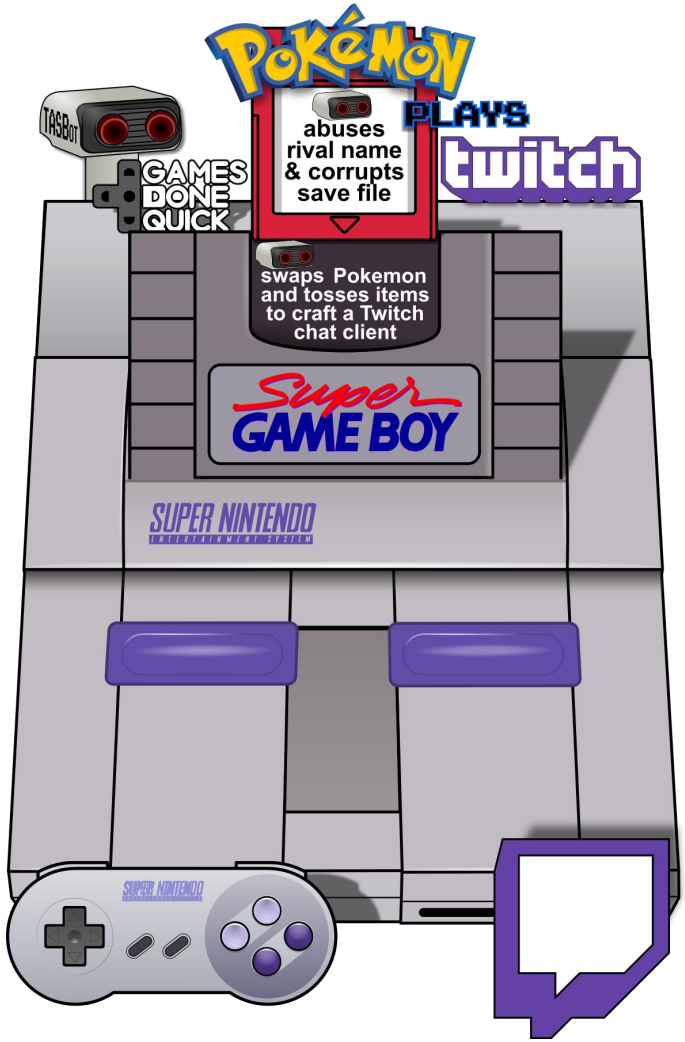



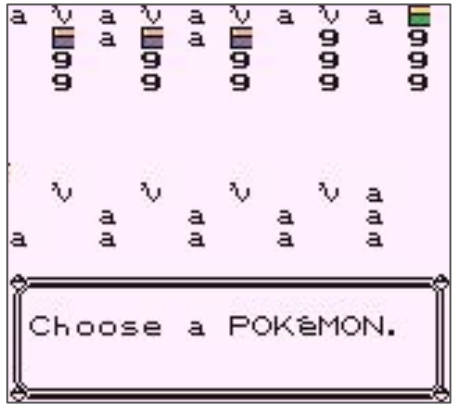





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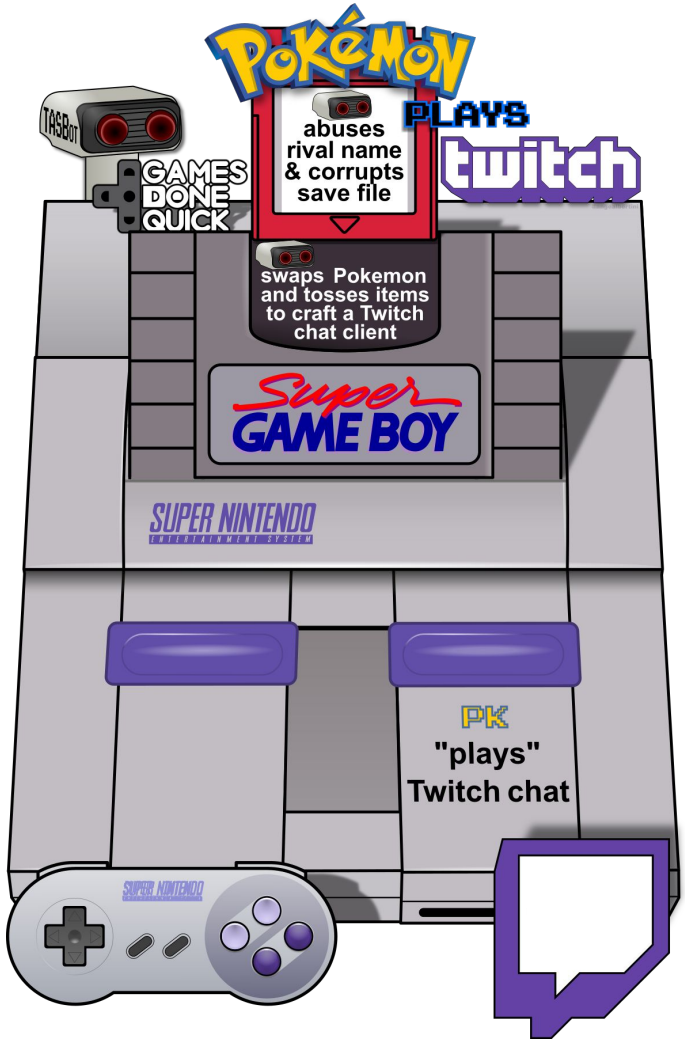



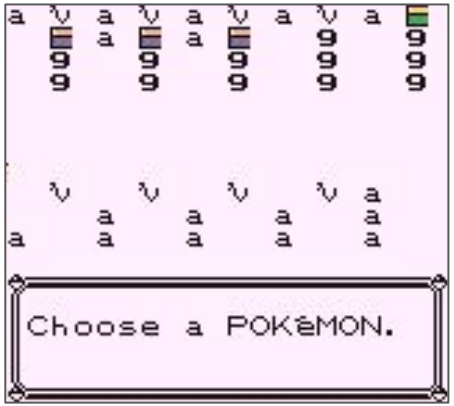





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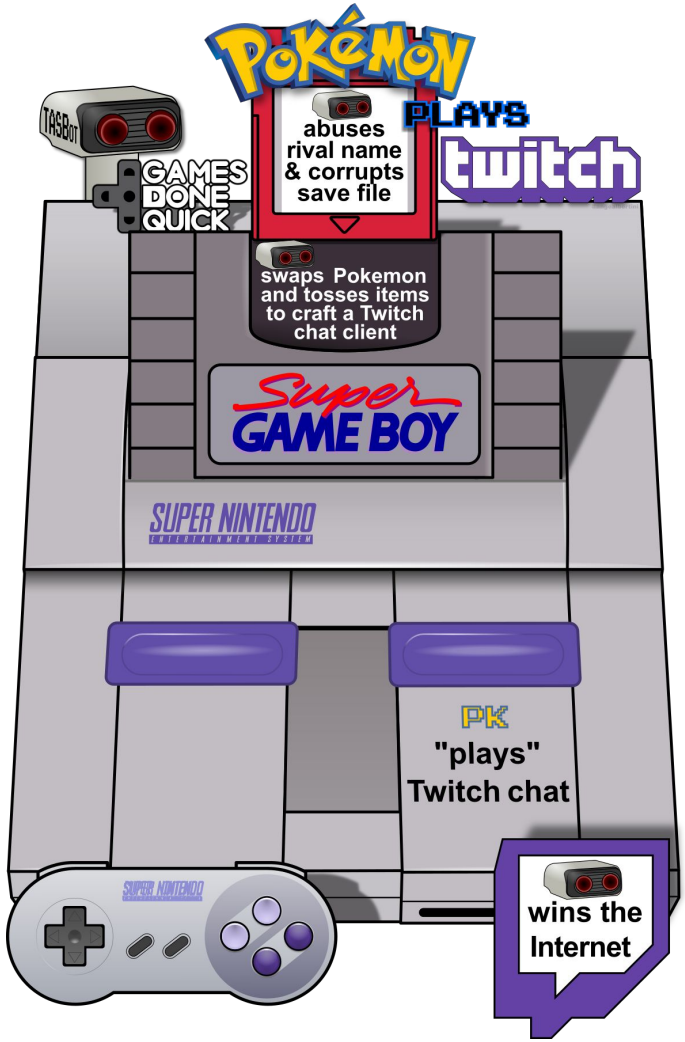
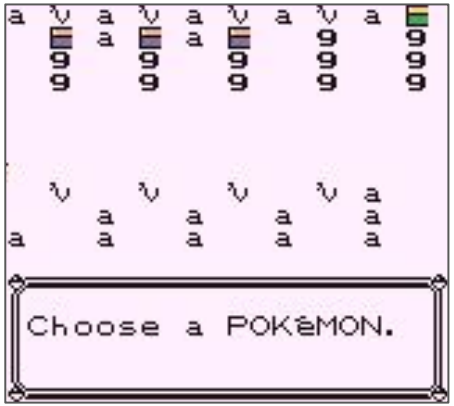
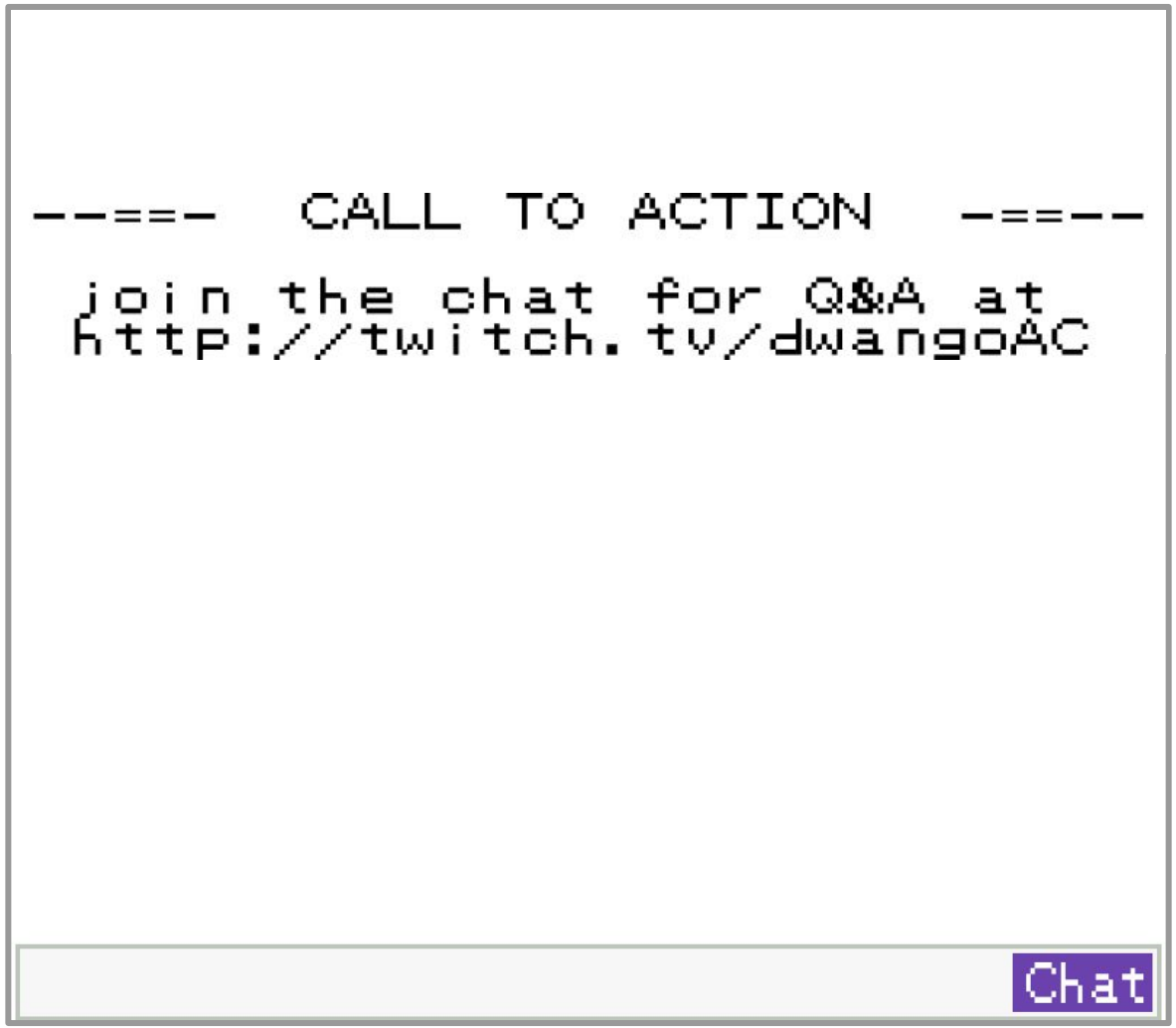








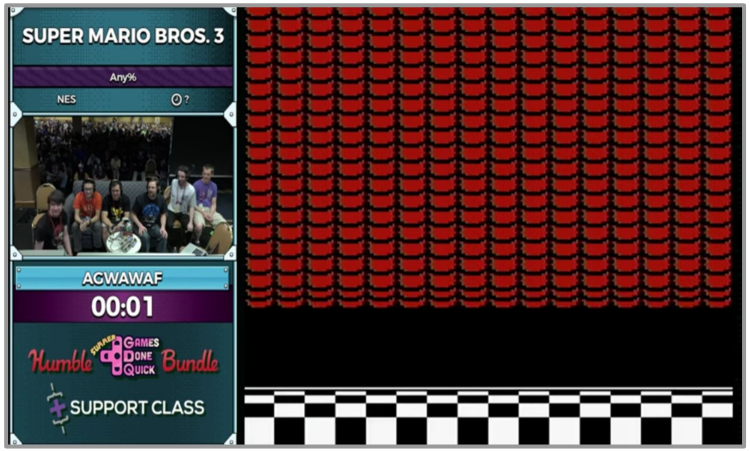



----- CALL TO ACTION -----
join the chat for Q&A at
http://twitch.tv/dwangoAC
Chat

https://youtu.be/EHfw-BEuRO8?t=1h13m50s

From boot...

credits: total_ ais523



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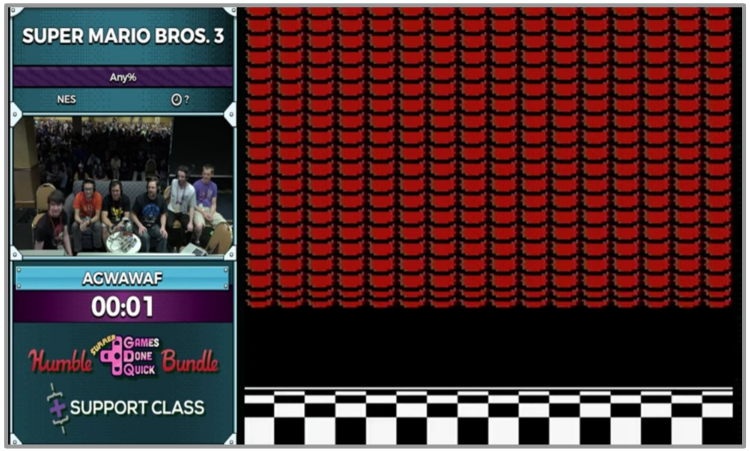
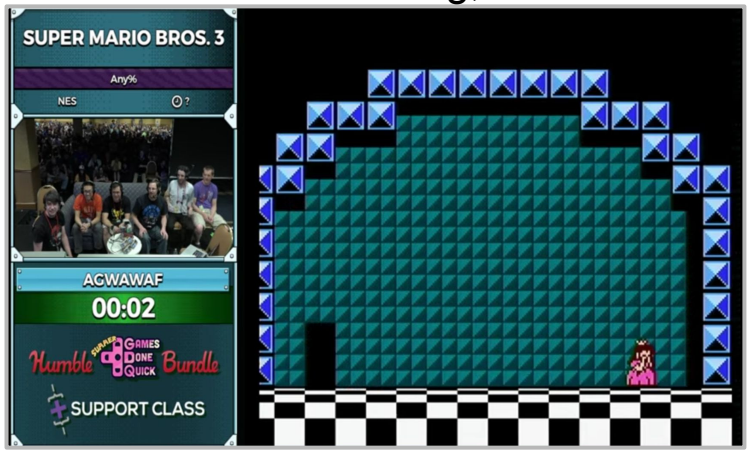


...to ending, in 16 frames!



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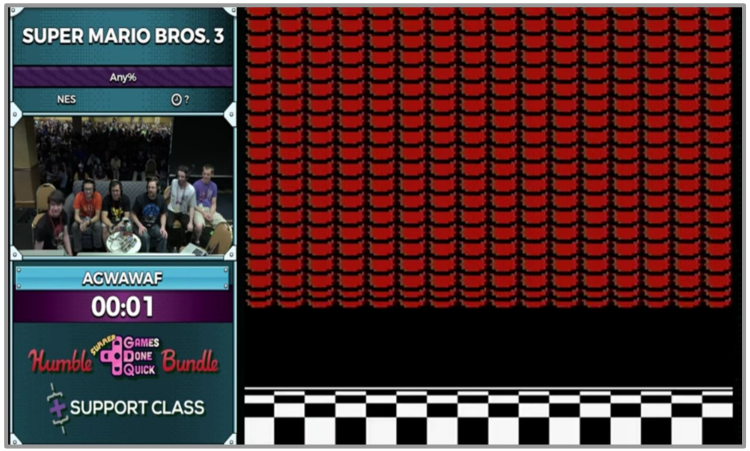

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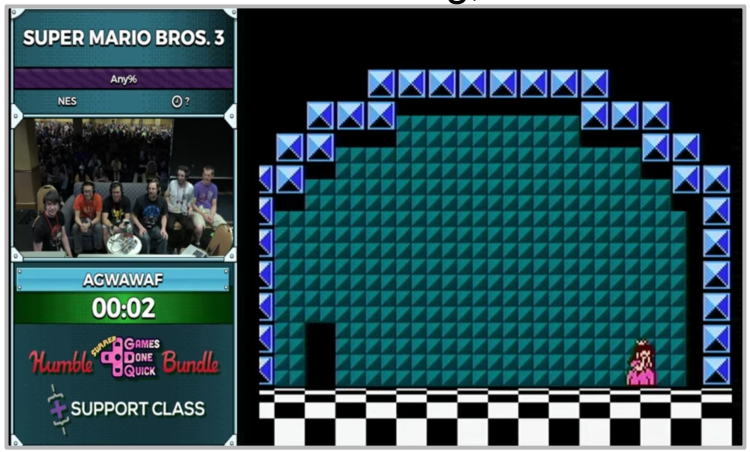
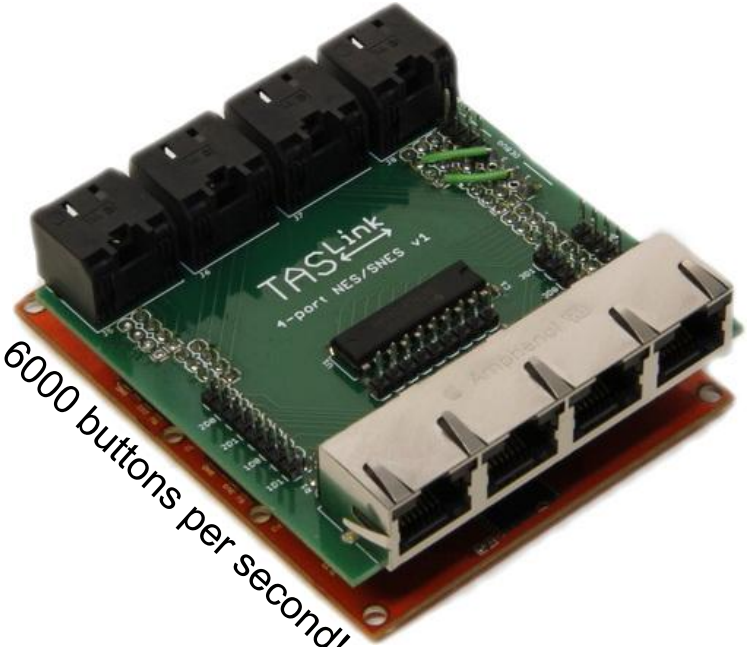
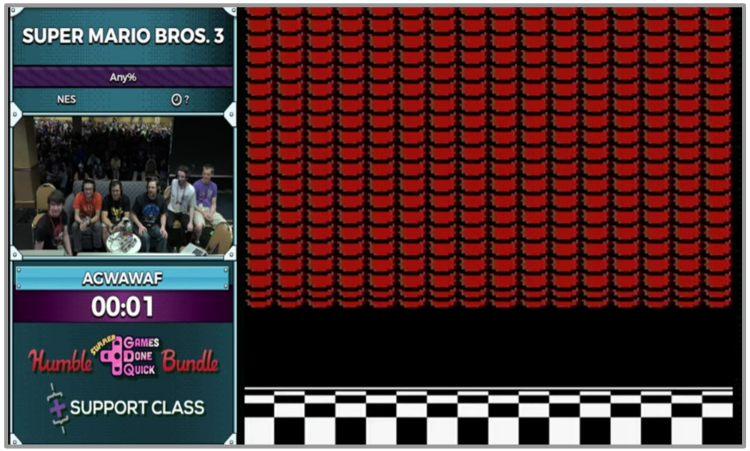




6000 buttons per second!

https://youtu.be/EHfw-BEuRO8?t=1h13m50s

From boot...

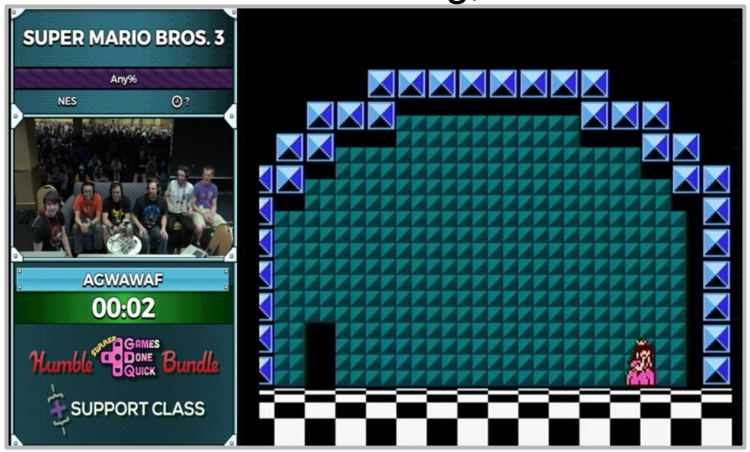


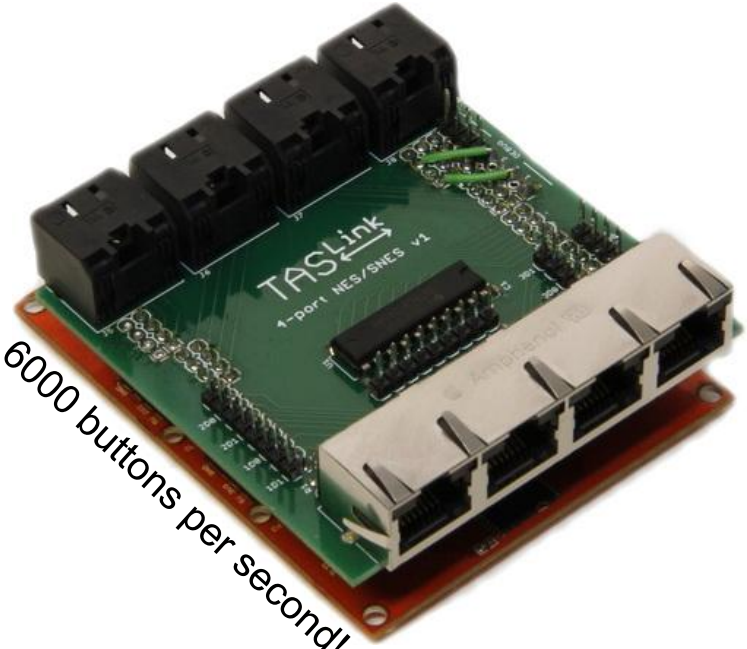
credits: total_ ais523

Some glitches are expected!



...to ending, in 16 frames!





6000 buttons per second!

DPCM memory

conflict

↓

game controller

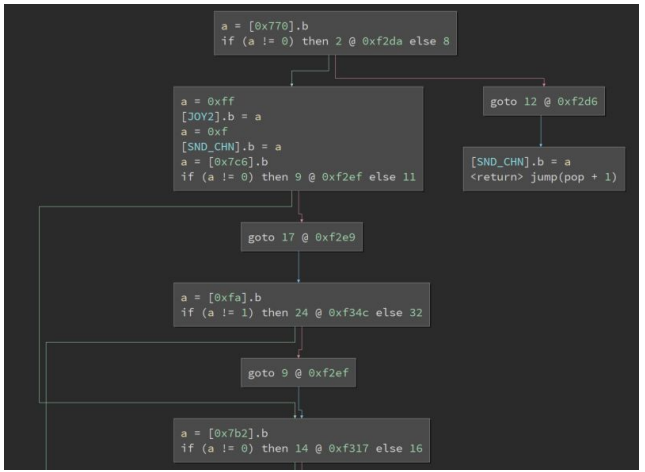
Flood weak controller code
to abuse raster interrupt
and take over execution

http://www.qmtpro.com/~nes/chipimages/#rp2a03
http://arstechnica.com/gaming/2016/07/how-to-beat-super-mario-bros-3-in-less-than-a-second/

TAS'ers lethal weapon

- More flexible than IDA
- Graph view, low level IL and annotation support
- Python scripting
- NES support: ability to add new mappers

BINARYNINJA



♫♪ Am I...

♫♪ Am I...

cheating?

♫♪ Am I...

cheating?

♫ No

♫♪ Am I...

cheating?

♫ No, I'm just looking for...

technical challenge & visual entertainment!

♫♪ Am I...

cheating?

♫ No, I'm just looking for...

technical challenge & visual entertainment!

♩ And I'm not the only one... ;)

♫ But more importantly....

♫ But more importantly....

over $200k USD

Raised for charity!







http://tasvideos.org/forum/viewtopic.php?p=437688#437688

Thanks to:

micro500 llari



Thanks to:

micro500 llari

p4plus2 Masterjun true

total_ psifertex rusty



Thanks to:

micro500 llari

p4plus2 Masterjun true

total_ psifertex rusty

TheAxeMan ange_ greenfly

ais523 and many, many others



Twitch.tv/dwangoAC



@MrTASBot





IN COLLABORATION
WITH ANGE ALBERTINI