Aesthetic Bot:

Interactively Evolving Game Maps on Twitter
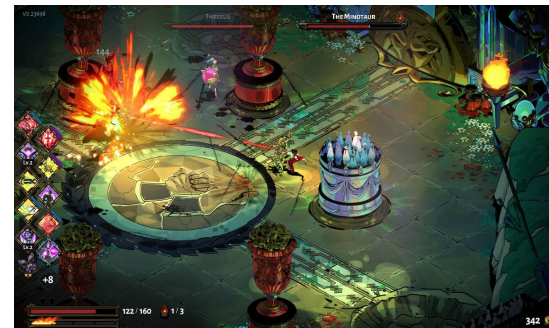
M Charity and Julian Togelius

Procedural Content Generation

Nethack (The NetHack DevTeam, 1987)
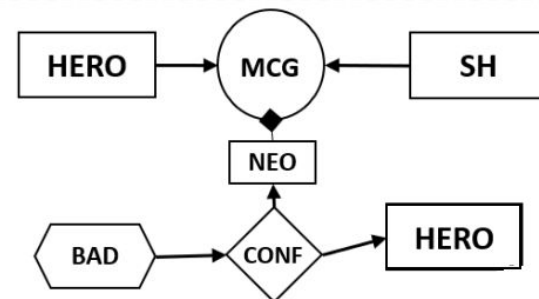

Spelunky (Derek Yu, 2009)

Hades (SuperGiant Games, 2018)

Baek, I. C., Ha, T. G., Park, T. H., & Kim, K. J. (2022, August)

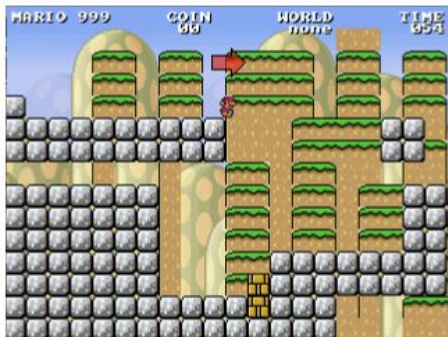
Hervé, J. B., & Salge, C. (2021, August)

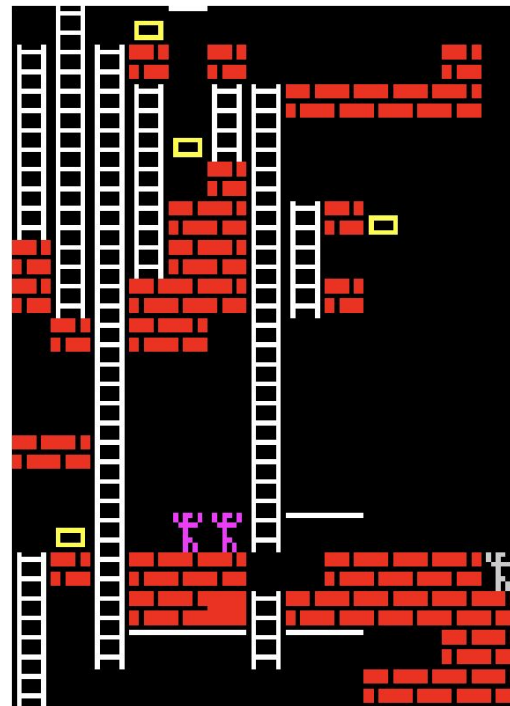Alvarez, A., & Font, J. (2022, September)

Proc-Gen's Elephant in the Room

Charity, M., Green, M. C., Khalifa, A., & Togelius, J.
(2020, September)

Charity, M., Dave, I., Khalifa, A., & Togelius, J. (2022).

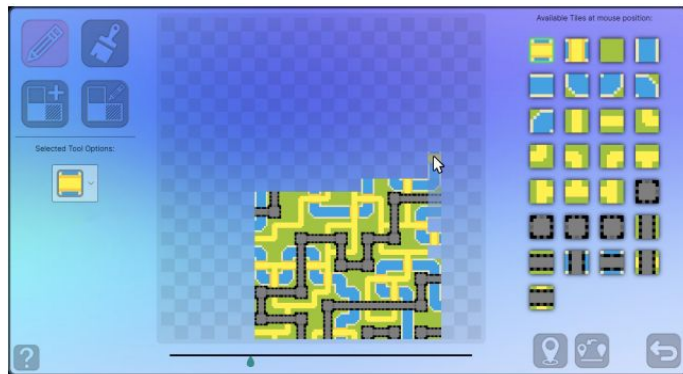Shaker, N., Togelius, J., Yannakakis, G. N. ... &
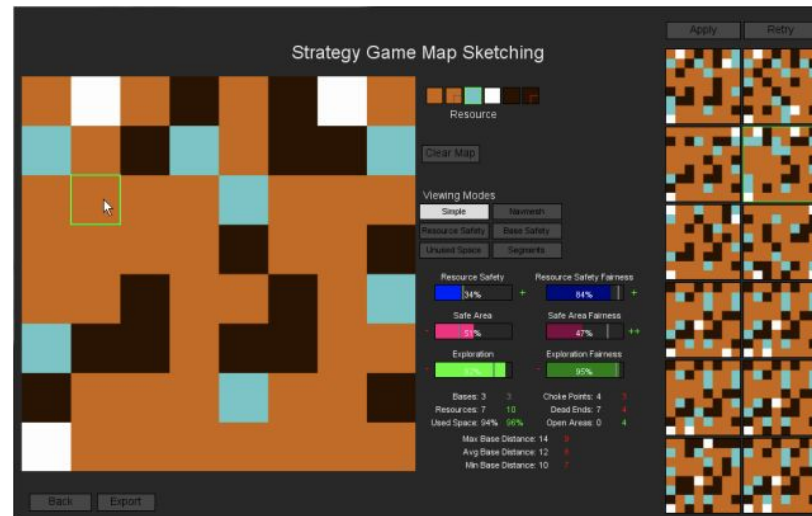Baumgarten, R. (2011)

Sorochan, K., Chen, J., Yu, Y., & Guzdial, M. (2021,
August)

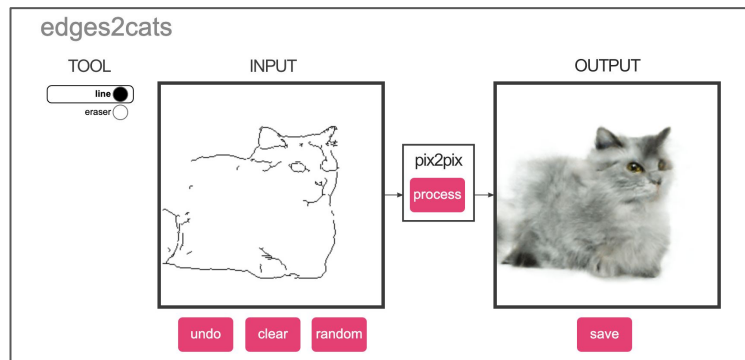Generators can get the job done, but don't care about making it look nice

Why not Interactive Evolution?

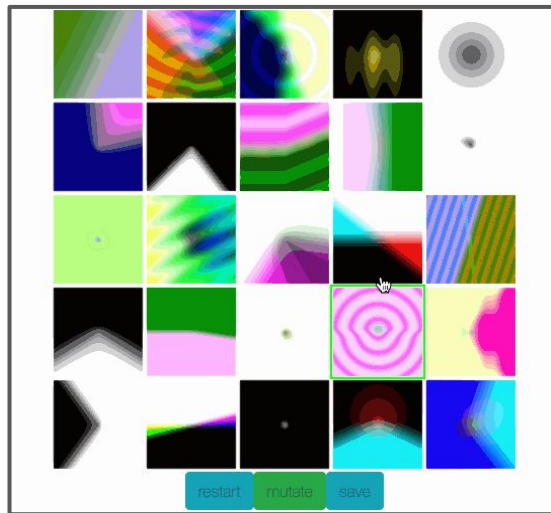Langendam, T. S., & Bidarra, R. (2022, September)

Isola, P., Zhu, J. Y., Zhou, T., & Efros, A. A. (2017)

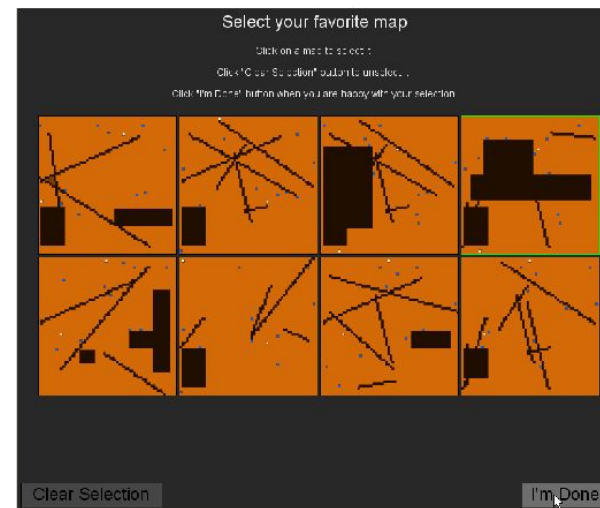Yannakakis, G. N., Liapis, A., & Alexopoulos, C. (2014)

Interactive Evolution's Elephant in the Room

Secretan, J., Beato, N., D Ambrosio, D. B., Rodriguez, A., Campbell, A., & Stanley, K. O. (2008, April)
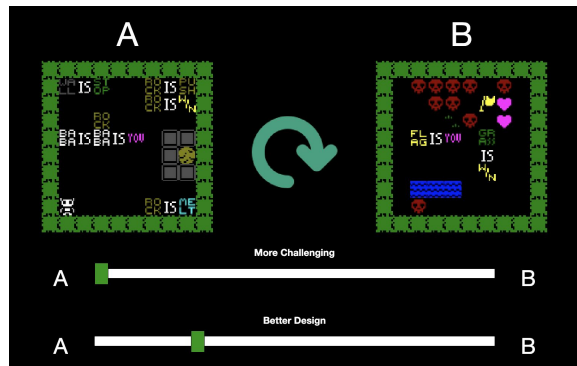
Charity, M., Dave, I., Khalifa, A., & Togelius, J. (2022).

Liapis, A., Yannakakis, G. N., & Togelius, J. (2012, October).

Humans get tired from evaluating hundreds of content samples

Aesthetic Bot

Procedurally generated game maps **evaluated (quickly and seamlessly)** based on preferential **visual appeal** and **aesthetic design** instead of playability
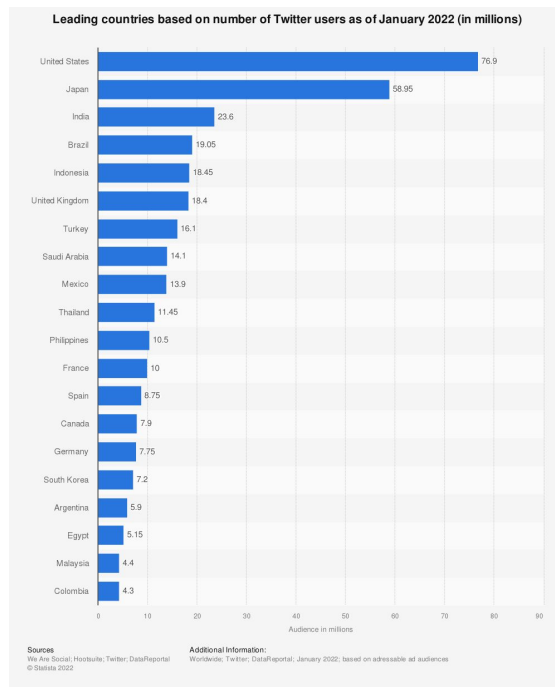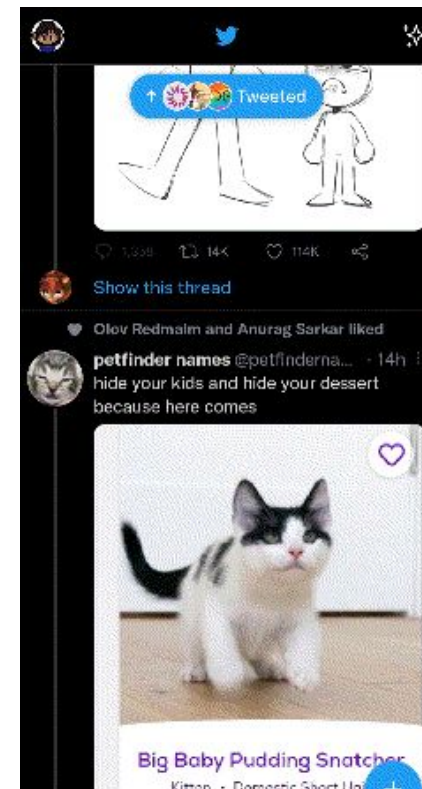
Wait… Why Twitter?

@EmojiMashupBot

haikookie @haikookies · Aug 30
Replying to @writeswithstyle
Define nice beer now
Everything fetches you curse
Conquer all zombies

@haikookies
Pichlmair, M., & Putney, C.
(2020, September)

Twitter bots (with supervision)!

Leading countries based on number of Twitter users as of January 2022 (in millions)

United States	76.9
Japan	58.95
India	23.6
Brazil	19.05
Indonesia	18.45
United Kingdom	18.4
Turkey	16.1
Saudi Arabia	14.1
Mexico	13.9
Thailand	11.45
Philippines	10.5
France	10
Spain	8.75
Canada	7.9
Germany	7.75
South Korea	7.2
Argentina	5.9
Egypt	5.15
Malaysia	4.4
Colombia	4.3

Audience in millions

Sources
We Are Social; Hootsuite; Twitter; DataReportal
© Statista 2022

Additional Information:
Worldwide; Twitter; DataReportal; January 2022; based on adressable ad audiences

Lots of (allegedly) human users!

Tweeted

Show this thread

Olov Redmalm and Anurag Sarkar liked

petfinder names @petfinderna... · 14h
hide your kids and hide your dessert
because here comes

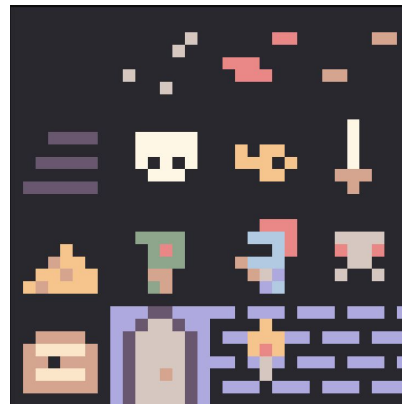Big Baby Pudding Snatcher
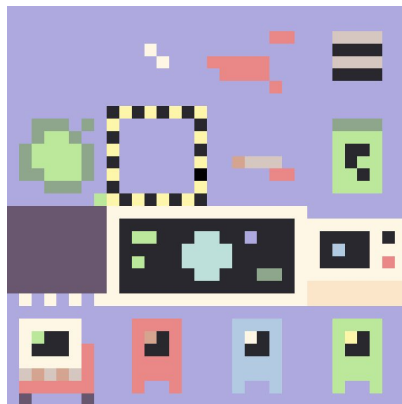Kitten · Domestic Short Hair

Constant flow of content
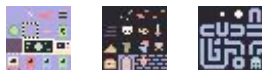
System Pipeline - Overview
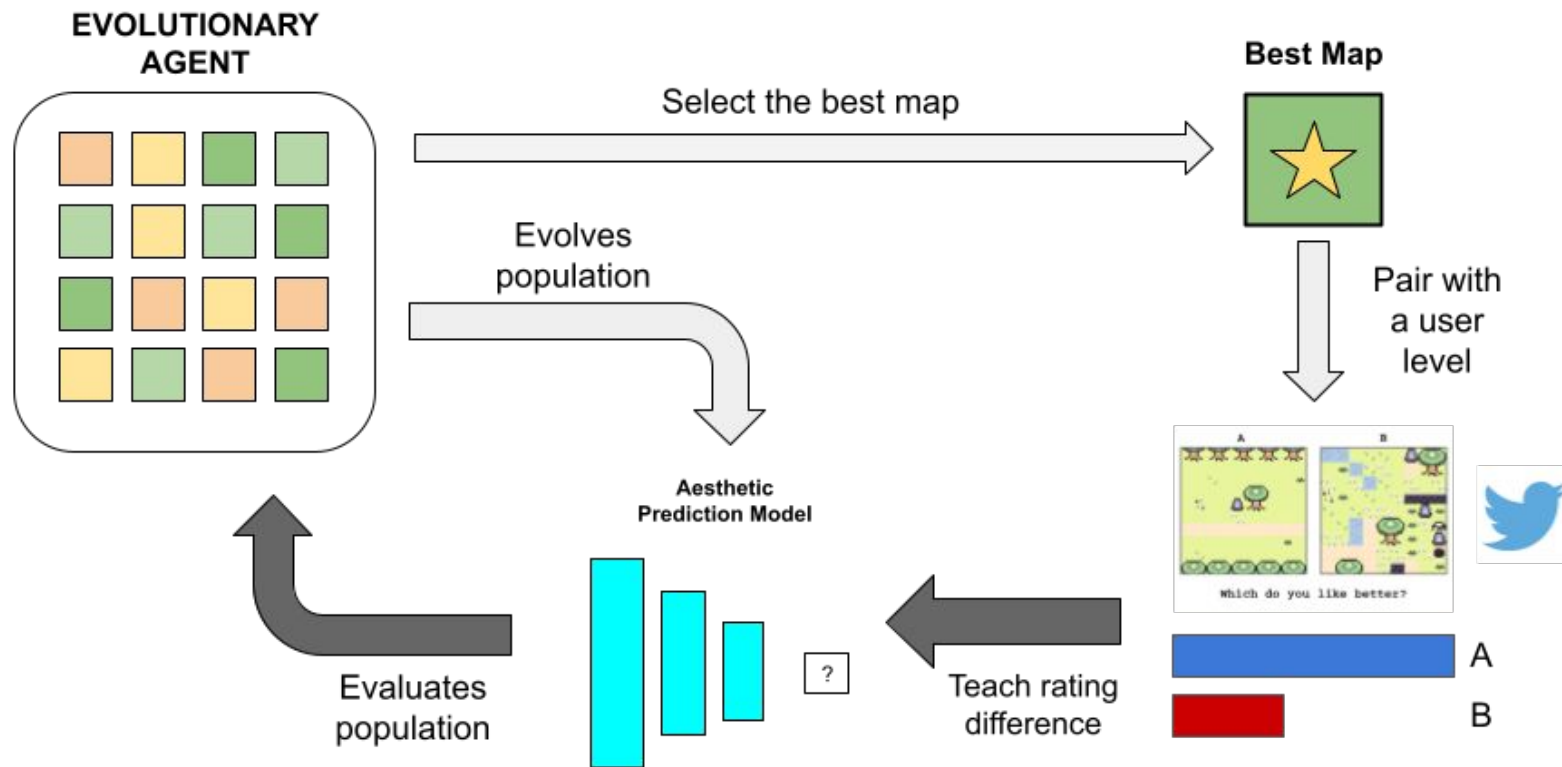
System Overview - Training Tilesets
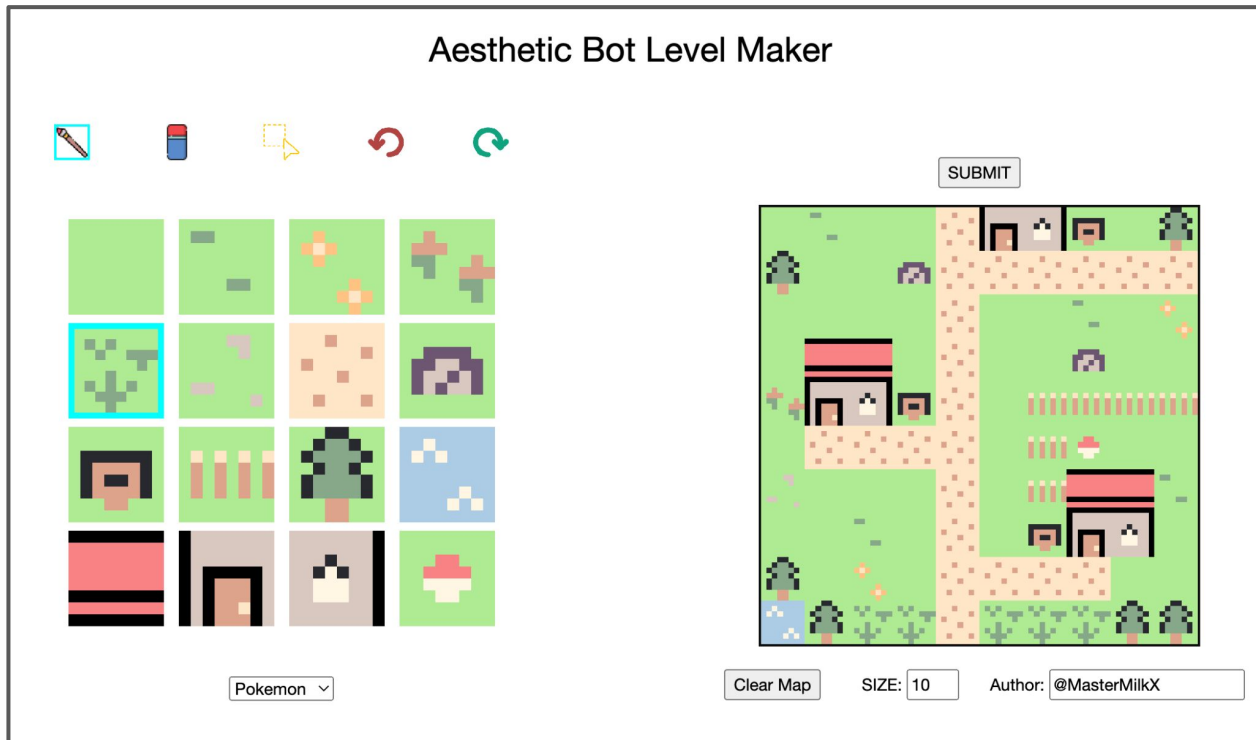
- **5 sets**
  - Among Us
  - Dungeon
  - Pacman
  - Pokemon
  - Zelda
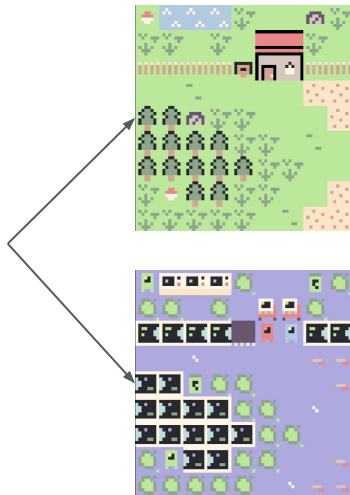- **16 tiles**
- **8x8 pixels / tile**
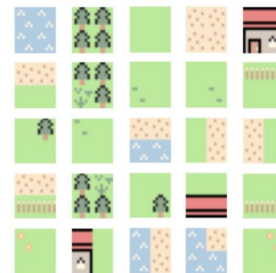
(actual size)

System Overview - User-made Maps

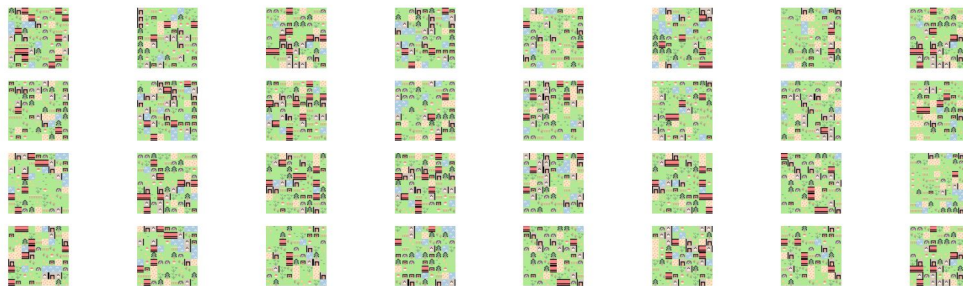
Mobile friendly!

System Pipeline - Evolutionary Agent

```
fbbb40074
44040cc40
99998de99
001000066
aa7440006
aaaa44010
aaaaa4400
4faa44006
444440166
```
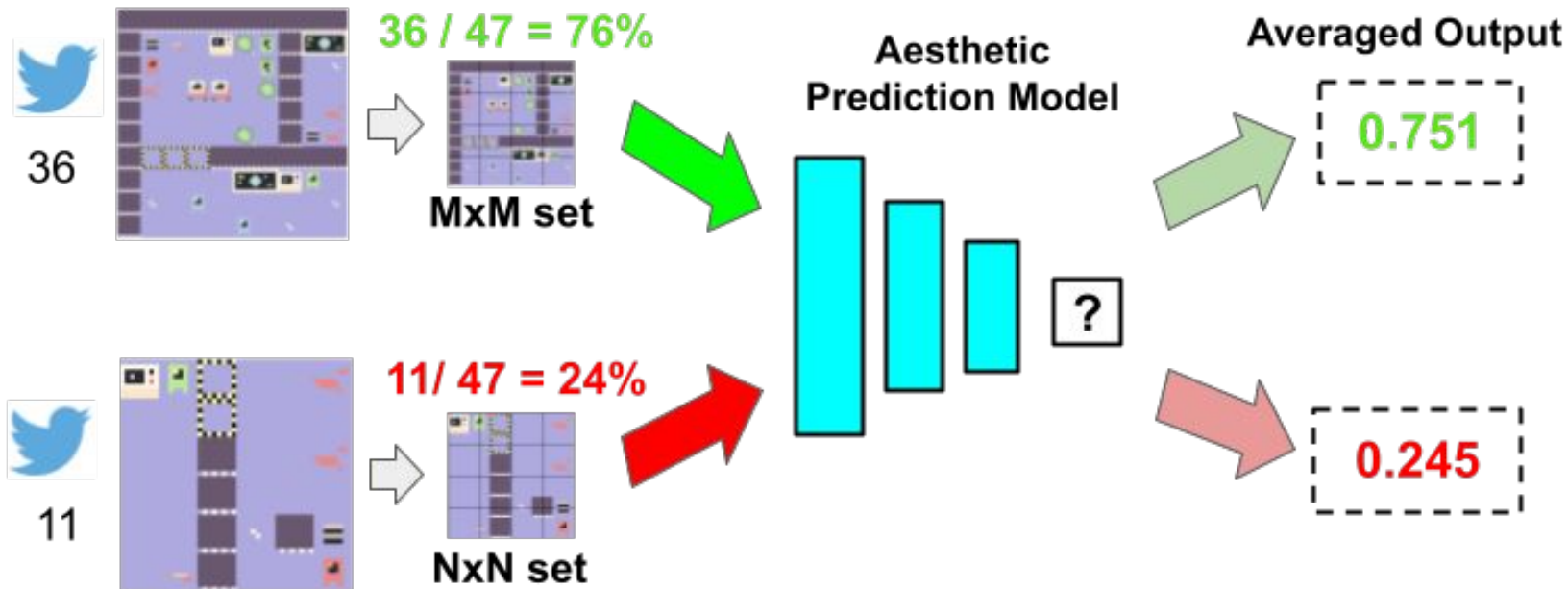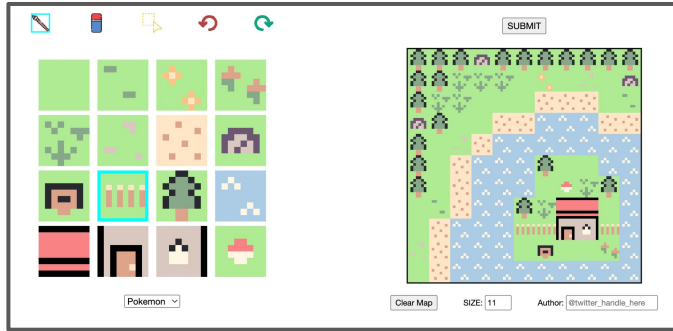

Random map

Tile pattern set
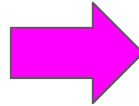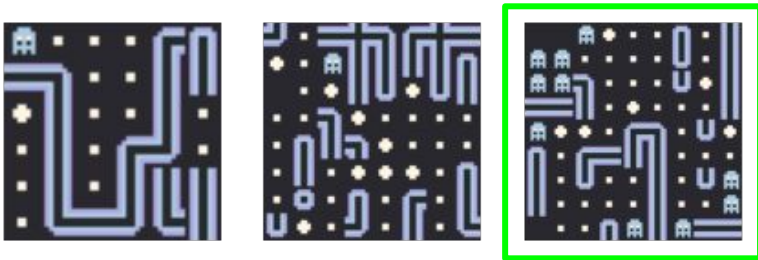
System Pipeline - Aesthetic Prediction Model

System Pipeline - Twitter Evaluation

User-made

AI-made

Interactive Twitter Bot
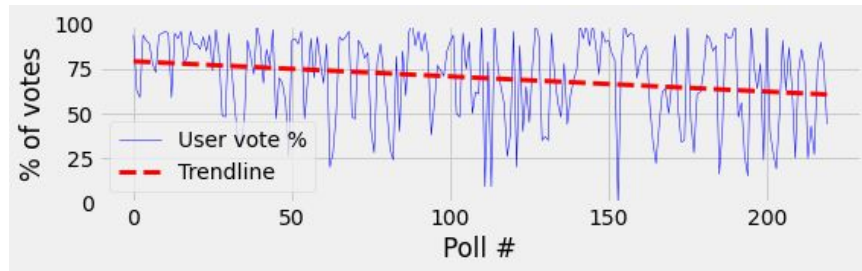
Experiment Stats - May 30th, 2022

Most Authored Submissions

1	**@Nifflas**
2	@MasterMilkX
3	dginev
4	@3phen
5	@AndresZarta

# of user maps per tileset

Zelda	101
Pokemon	108
Among Us	31
Pacman	69
Dungeon	90

% of votes for User-made map

# of votes per polling
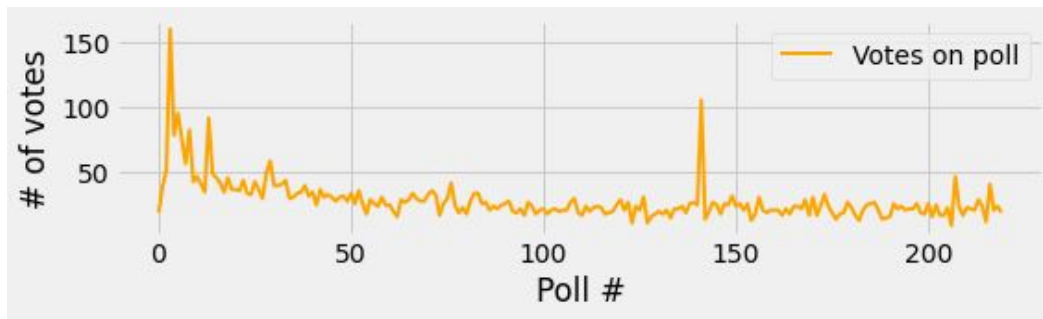
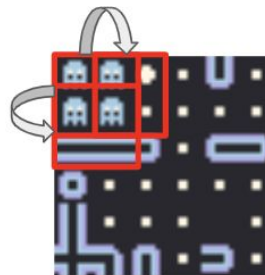# Post Experiment - August 4th, 2022

> User maps win 78% of votes on average

@Nifflas (aka designer of Knytt)
- 135 / 733 (18.4%) of all submitted maps
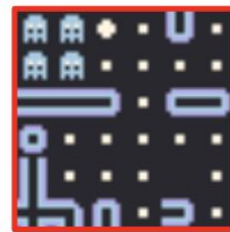- wins 94% of polls (including against humans)

Prediction Experiment:
Sliding Window vs. Entire Map

APM vs. POST

Map Size		6		10	
Network		APM	POST	APM	POST
	Zelda	**0.1363**	0.1564	**0.1061**	0.1492
	Pokemon	**0.1596**	0.2011	**0.1157**	0.1319
	Among Us	**0.2136**	0.2272	**0.1150**	0.1159
	Pacman	**0.1309**	0.1488	**0.1419**	0.1616
	Dungeon	**0.1327**	0.1761	**0.1545**	0.1657

Average % error on poll win prediction

Types of Aesthetic

Which do you prefer?

| 1 | 2 | 3 | 4 | 5 |
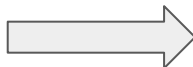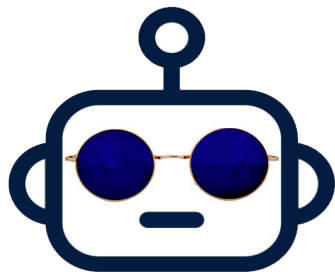
Random < **Patterned** 👍
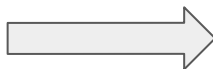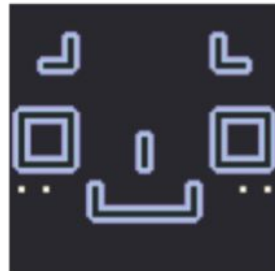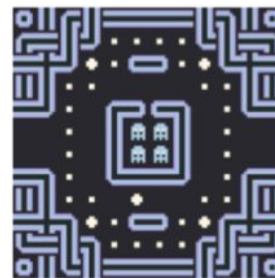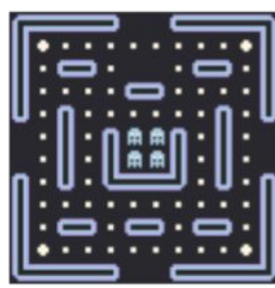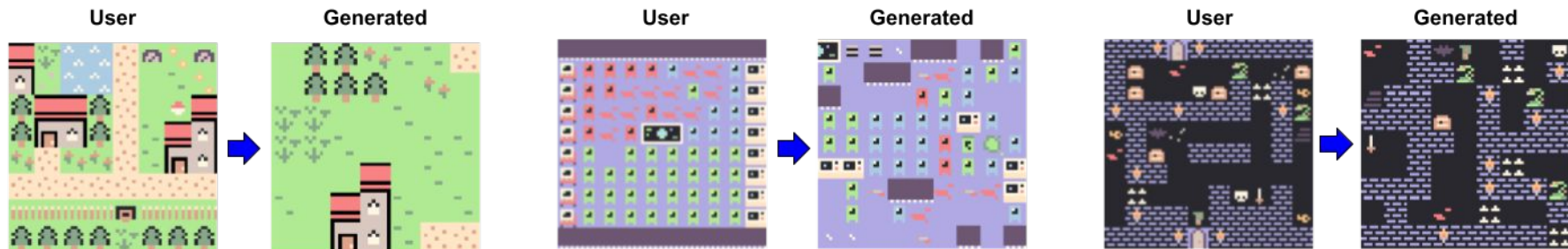
Minimalist
Symmetry
Entropy
Variation
Color Attraction
etc.

?

Level-like, Hacked, and Non-Ludic User Maps

Learning Trends

April   May   June   July   August

Conclusions and Future Work

- Introduce a new form of interactive evolution via Twitter polling
- Attempt to generate content solely for aesthetic purposes
- Aesthetics come in many forms - still hard to teach AI
- Ongoing evaluation from Twitter population constantly updating the network

- Apply Aesthetic Bot as a post-process generator/decorator to real game levels
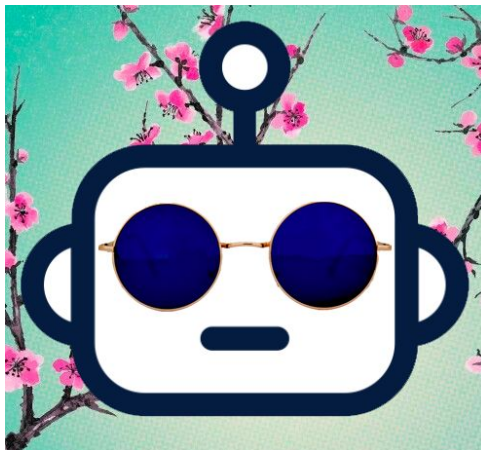- Develop more bots with 2-way feedback system via social media

Thank You!

Arxiv Paper
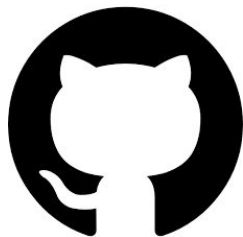
Follow me on Twitter!
@AestheticBot_22

(Follow us too!)

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mlc761@nyu.edu

@togelius
julian@togelius.com