

Automated Daily Production of Evolutionary Audio Visual Art — An Experimental Practice

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Evolutionary Art

- K. Sims, W. Latham, S. Rooke, M. Lewis, E. Lutton, P. Machado, S. DiPaola, G. Bachelier, ...
- Generative Art
- Interactive Evolutionary Computing
 - Selection by Human's choice.
- Automatic Art
 - Art made by the machine.
- Automated Evolutionary Art
 - Selection by Computational Aesthetic Measures

Functional Expression as Genotype

- Mapping from (x,y,t) 3D coordinate to HSB (hue, saturation, brightness) color value.
- Genetic Programming.
 - subtree exchange as crossover.
 - symbol replacement as mutation.
- Acceleration by GPU
 - Compilation into GLSL (Shader Language)

Small-grained generation alternation

- Synchronized generational change needs much of computational cost to get NEXT one!
- Selects two parents to spawn two children, then ...
- Steady state GA [Whitley 88].
- Minimal generation gap model [Sato 97].
- Parameter Free GA [Sawai 98].

Aesthetics

- What do we feel beautiful about?
- Emotional impression ... connected to the individual cultural background ...
- But, it must also be supported by signal processing in our sensory organs and nervous system.
- ... Computational something ...
- Evolutionary Psychology
- Rational Background of Information Processing.

Computational Aesthetic Measures

- Complexity.
 - Using JPEG compression.
 - Global Contrast Factor.
- Frequency distribution of color values.
 - Power law, $1/f$, Zipf's law, Benford's law, ...
- Composition
 - Symmetry, Rhythm, Balance, 1/3 rule, Golden ratio, Fibonacci, Fractal, ...

Aesthetic selection as Multi-objective optimization

- Combination of measures.
 - Normalization.
 - Correlation.
 - Weighted average? Geometric mean?
 - Pareto optimal solution set... then?
- ... Weighted Geometric Mean ...
 - All of measures seem necessary conditions.
- Convergence vs. Diversity

Measures in SBArt4

- Frequency distribution of hue values.
- Frequency distribution of brightness.
- Distance from ideal saturation in average and variance.
- Complexity estimated by JPEG.
- Global contrast factor in Colors.
- Distribution of edge angles.
- Average color differences between consecutive frames (in 10 samples).

Daily Production

- Scheduled production, launched every morning.
- Combination of SBArt4, QuickTime player, ffmpeg, curl, etc.
Controlled by AppleScript.
- 200 steps of evolution from a random population. (90 min. by MacPro 2006)
- Publishes the best 10 pieces.
- Remote recovery by VCN when troubled.

How to show

- **Installation of automatic art.**
 - **Exhibition setups**
 - **Two Mac minis, Projector and Audio System**
- **Live Performance: Breeding on stage.**
 - **Real-time control by the performer.**
- **Daily Evolved Animations.**
 - **Full automatic production and publication.**

Web-based publication

- Automatic production, publication, and announcement.
- Everyday since October 6th, 2011.
 - conducts 200 steps of evolution.
 - publishes the best 10 individuals.
- Movie files. m4v and ogg
- WebGL + HTML5 (JavaScript)
- Special Application Software for the viewers.

by Movie file

- Ten 20-seconds-movie files everyday.
- Format
 - m4v (MPEG4 + AAC) for Safari, iOS, ...
 - ogg (vorbis theora) for Firefox
 - Video: 810x540 pixels, 30 FPS
- Quality vs. File size
- Disk space consumption. 126GB per year.
- GUI: Calendar to select a date,
Thumbnail images to select a piece.

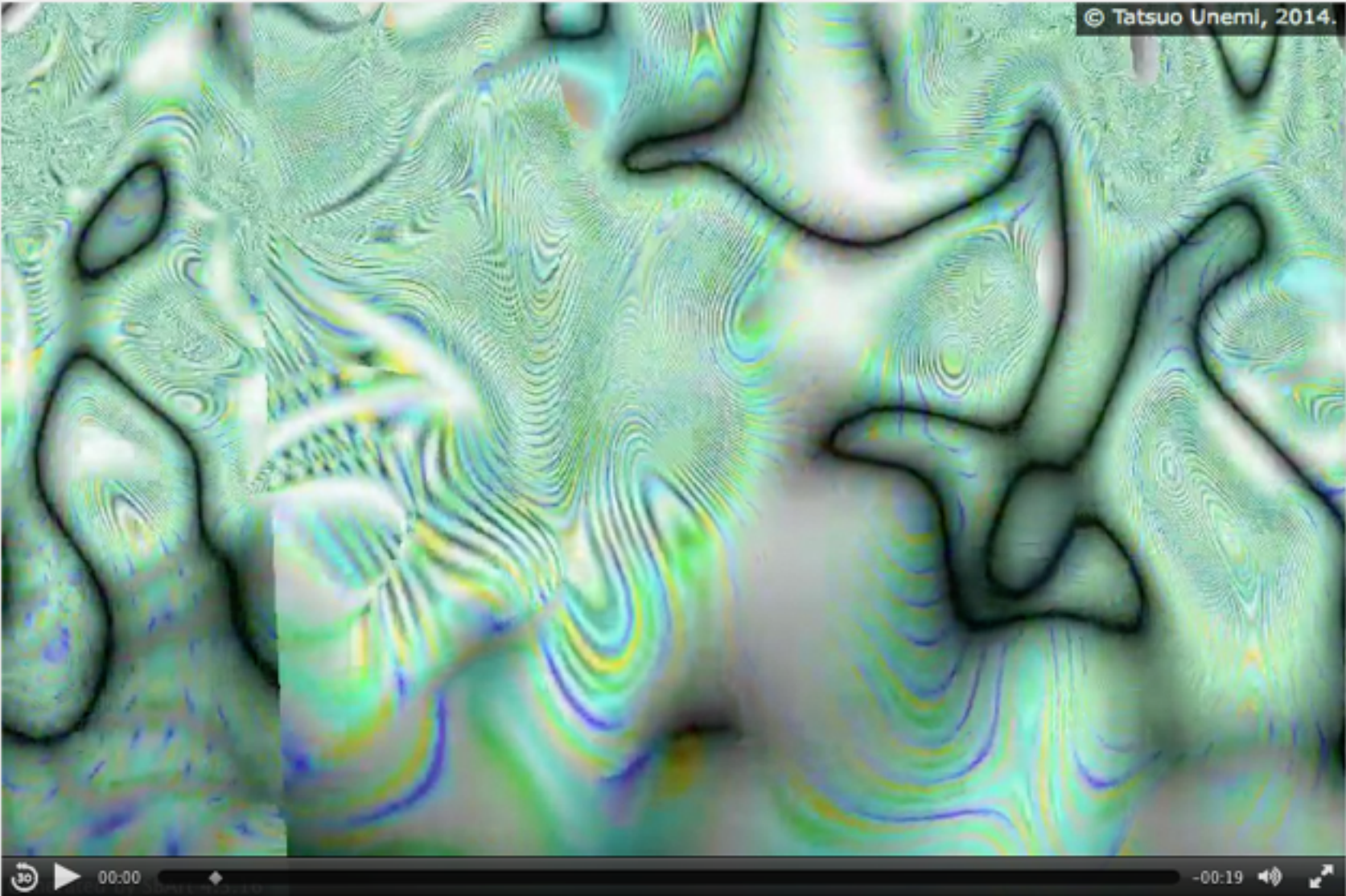
161718192021222324252627282930October01020304050607080910111213141516171819202122232425262728293031November01020304050607080910111213141516171819202122232425262728293031December010203040506070809101112131415161718192021222324252627282930312014January01020304050607080910111213141516171819202122232425262728293031February0102030405060708091011121314

SBArt4 Daily Evolved Animation

This is a fully automated production of evolutionary art organized by [Tatsuo Unemi](#). The computer wakes up every morning in Japan Standard Time, and then executes an evolutionary process to obtain complex abstract animations that satisfy a type of evaluation criteria based on computational aesthetic measures. The best ten pieces are added everyday to be exhibited here. Please visit [SBArt4 home page](#) for more detail on the project. This site is based on a playback of the movie files. Please visit [WebGL-based site](#) for clearer images without any loss due to video compression. You can download the [Daily Evolved Animation Viewer](#) that runs on MacOS X 10.6 or later.

2014/02/13

2014/02/14



00:00

00:19

Playback Loop: [☒Random ☐Forward ☐Backward ☐None] Resolution:

Generated by [SBArt4](#)

<http://www.intlab.soka.ac.jp/~unemi/sbart/4/DailyMovies/index.html?9635>

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HTML5 + WebGL

- WebGL ... API sets for JavaScript to render 3D CG in a Web Browser.
- Capable of shading by GLSL ES.
- Sound effect by audio file.
- Periodically re-draw the image,
Playback time \rightarrow T value of the image.
- Lossless visual
- Overhead of control by JavaScript.

21 22 23 24 25

26 27 28 29 30

December

01 02 03 04 05

06 07 08 09 10

11 12 13 14 15

16 17 18 19 20

21 22 23 24 25

26 27 28 29 30

31

2014

January

01 02 03 04 05

06 07 08 09 10

11 12 13 14 15

16 17 18 19 20

21 22 23 24 25

26 27 28 29 30

31

February

01 02 03 04 05

06 07 08 09 10

11 12 13 14 15

16 17 18 19 20

21 22 23 24 25

26 27 28

March

01 02 03 04 05

06 07 08 09 10

11 12 13 14 15

16 17 18 19 20

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26 27 28 29 30

31

April

01 02 03 04 05

06 07 08 09 10

11 12 13 14 15

16 17 18 19 20

21 22 23 24 25

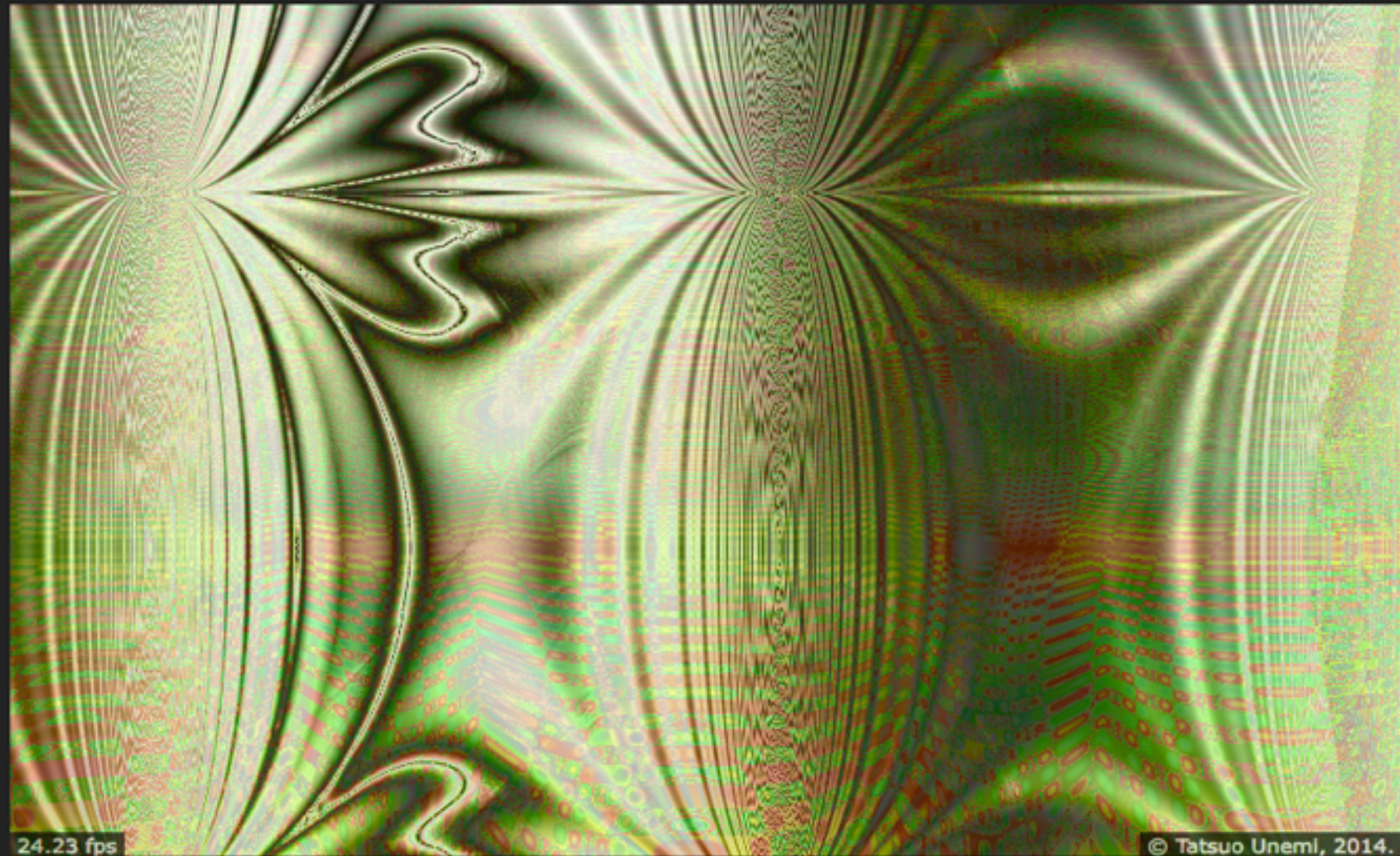
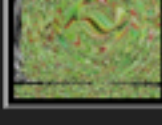
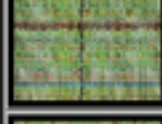
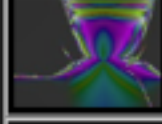
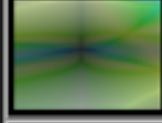
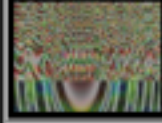
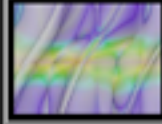
SBArt4 Daily Evolved Animation on WebGL

This is a fully automated production of evolutionary art organized by [Tatsuo Unemi](#). The computer wakes up every morning in Japan Standard Time, and then executes an evolutionary process to obtain complex abstract animations that satisfy a type of evaluation criteria based on computational aesthetic measures. The best ten pieces are added everyday to be exhibited here. Please visit [SBArt4 home page](#) for more detail on the project. [\(Version History\)](#)

You can download the [Daily Evolved Animation Viewer](#) that runs on MacOS X 10.6 or later.

2014/04/24

2014/04/25



24.23 fps

© Tatsuo Unemi, 2014.



00:02

☒ Show FPSPlayback Loop: [☒ Random ☐ Forward ☐ Backward ☐ None]Sound: [☐ Rhythmic ☒ Synchronized]


Frame size:


 Full Screen Default Smaller Larger Adjust to current window size


DEAViewer


- Specific application software running on OS X 10.6 or newer.
- Controlled by compiled machine codes.
- OpenGL APIs.
- GUI design, Printing utility, ...
- Available at App Store in free of charge since February 2013.
- 911 downloads, so far (June 6, 2014)


SBArt4 Daily Evolved Animation: April 24, 2014 [4]


Mode


Go Back


Rewind


Play


Go Next


Next Date


Calendar


Thumbnails

Print

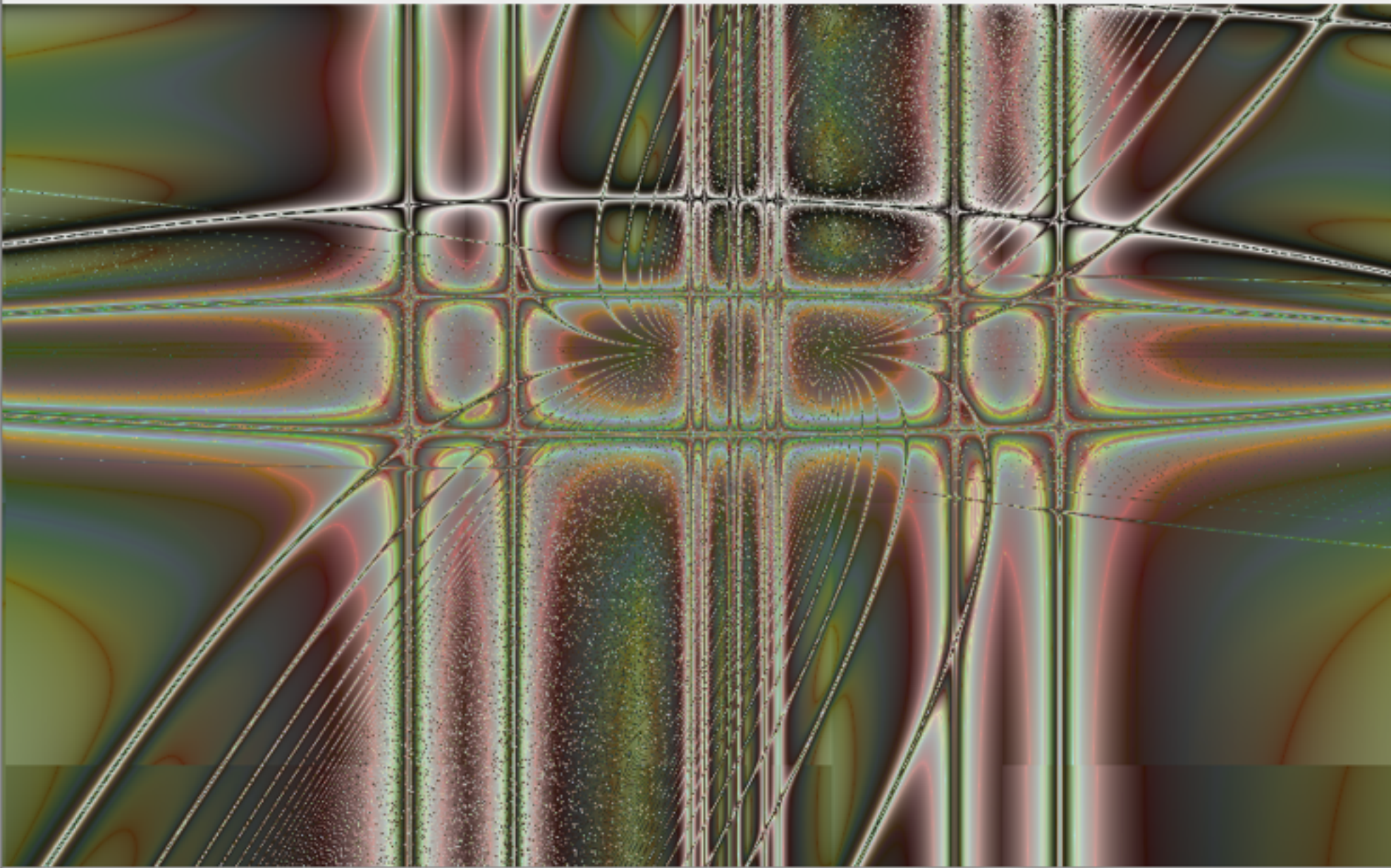
Preferences

Volume

Full Screen

About this

11:40



This motion CG was automatically produced by an evolutionary computation based on computational aesthetic measures.

© 2014, Tatsuo Unemi.

April

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

July

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31					

October

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31				

January

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	

April

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

SNS Announcement

- Digest movie on YouTube
 - One minute movie containing 6 seconds excerpts for each (daily).
 - 2 min. 20 sec. movie containing 2 seconds excerpts from 70 pieces (weekly).
 - Pots it to FaceBook via "connection."
- Twitter @SBArt4_bot
 - posts URL of YouTube and WebGL site.

Future Extension

- Statistic analysis over the produced pieces on aesthetic measures, genotypes, etc.
- Non-stop production.
 - balance between convergence and diversity must be maintained.
- Aesthetic measurement on motion.
 - Optical flow is useful?

Please Enjoy!

- <http://www.intlab.soka.ac.jp/~unemi/sbart/4/DailyWebGL/>

