

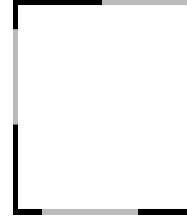
“Generative Justice: Computational Mathematics and Social Self-Organization”



This project began with the discovery of fractals in African material culture

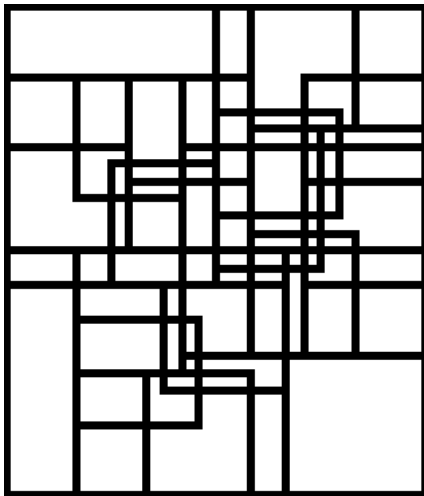
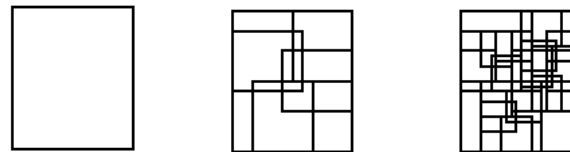


I first modeling the Logon-Birni Palace with a recursive line replacement algorithm, assuming it was unconscious, bottom-up social dynamics responsible for its shape



The 1st iteration or "seed" shape:
Grey lines active -- they get replaced by whole shape.
Black lines passive -- they are not replaced.

All three iterations:

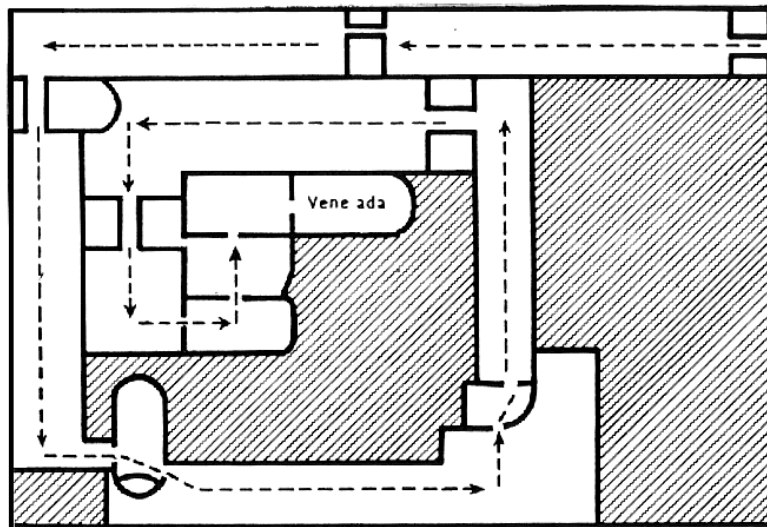


Third iteration of the fractal model:
scaling gets smaller towards center.

But interviews revealed that there was conscious knowledge of the scaling characteristics

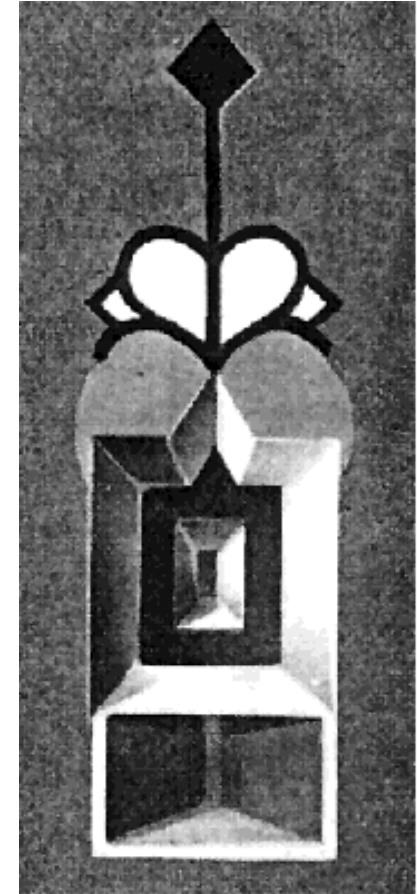


Photo in 1993 taken from the roof of the palace.



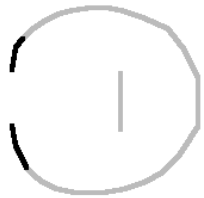
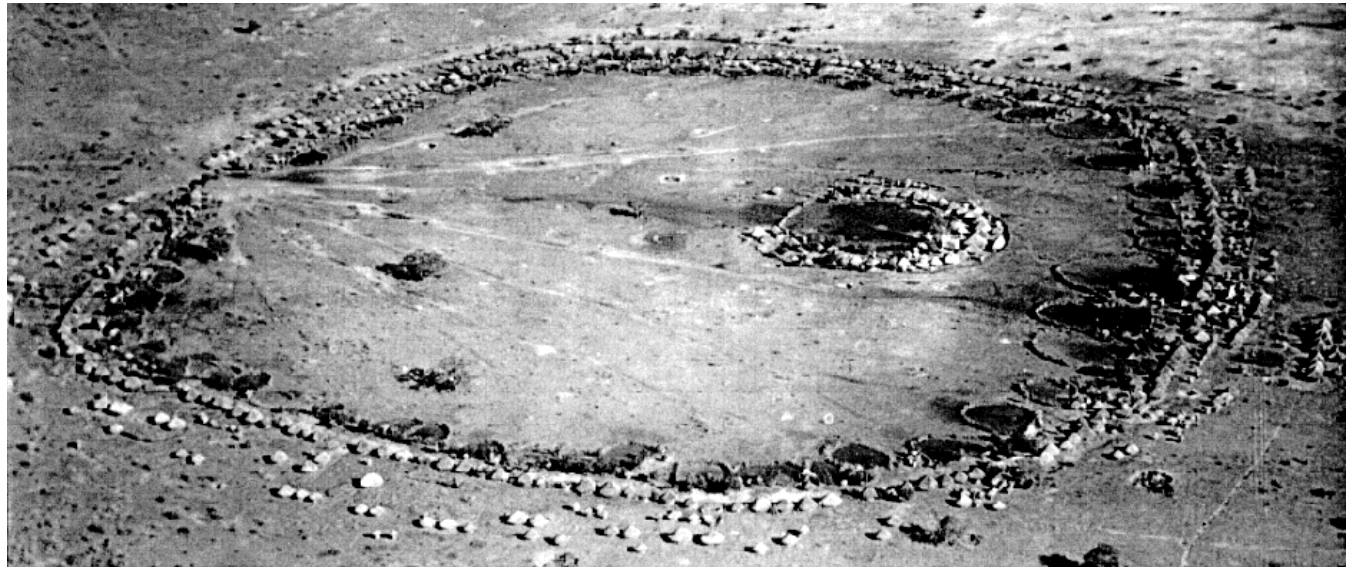
Le chemin de la lumière.

The spiral path taken by visitors to the throne.

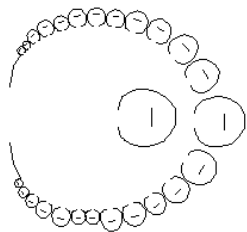


Center motif of the guti, the royal insignia, painted on the palace walls.

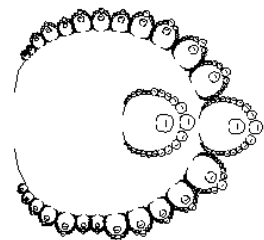
Fractal model of Ba-ila settlement



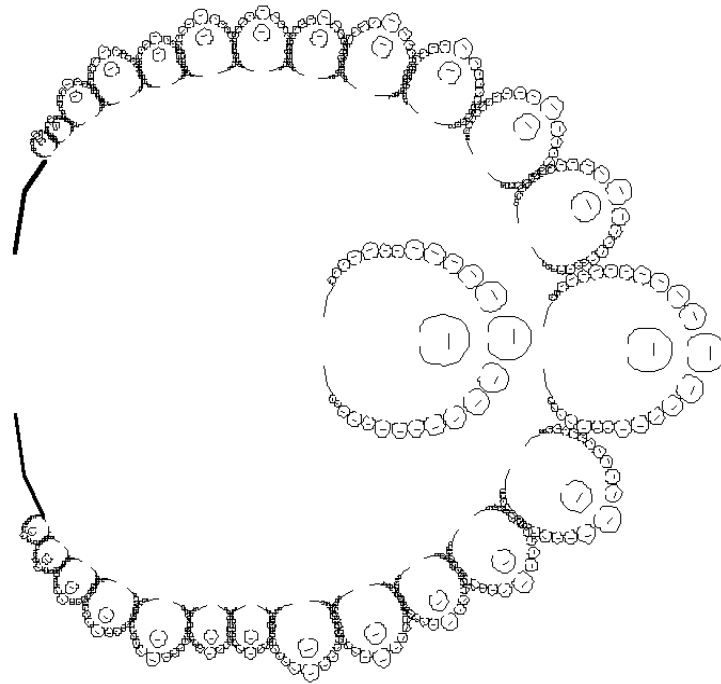
1



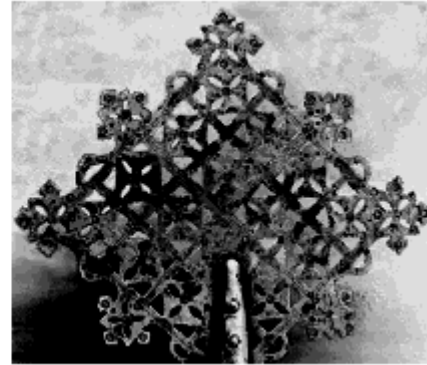
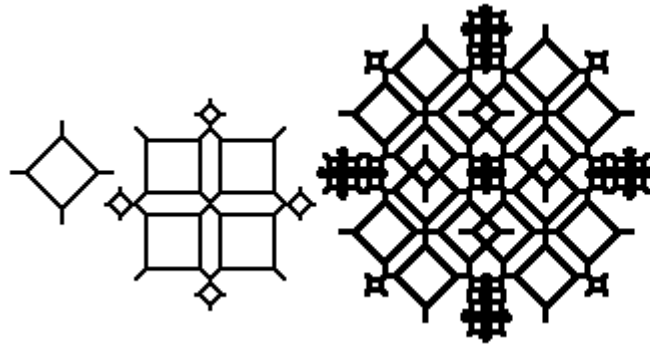
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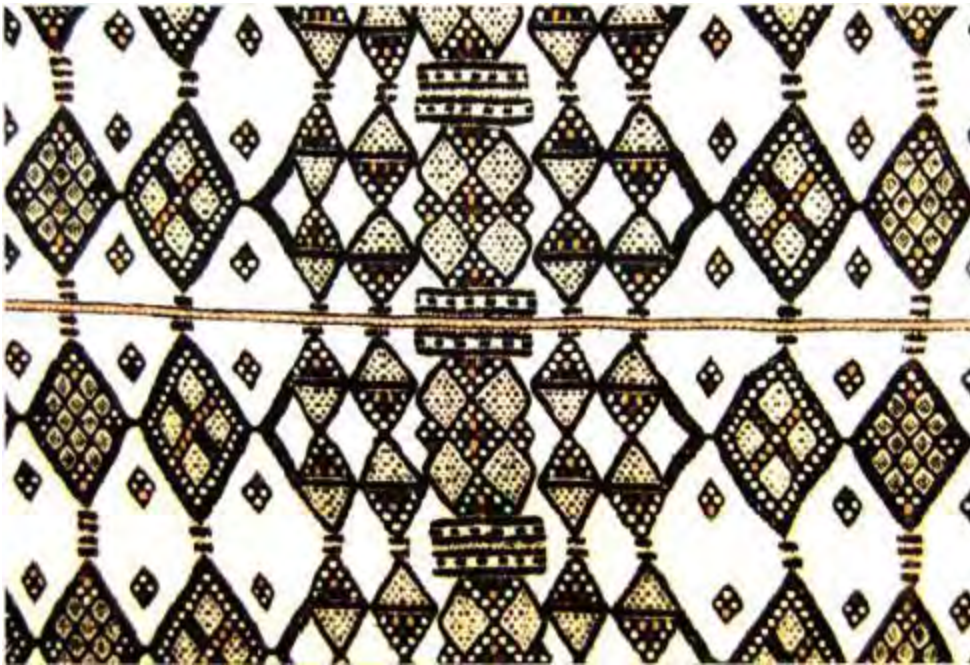
3



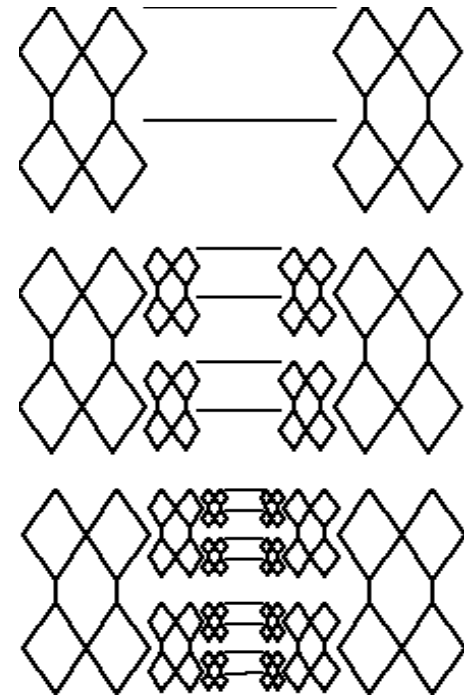
Recursive construction techniques



Three iterations gives simulation of Ethiopian cross

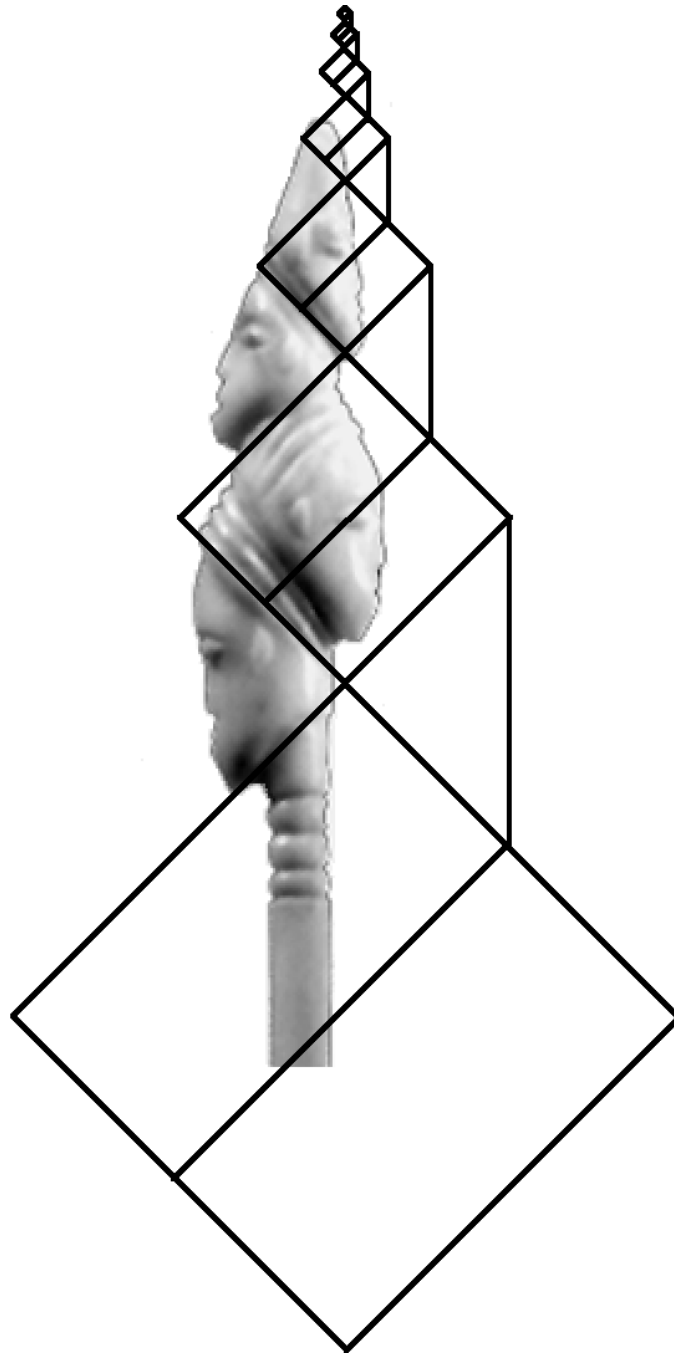


Fulani wedding blanket



Simulation for blanket

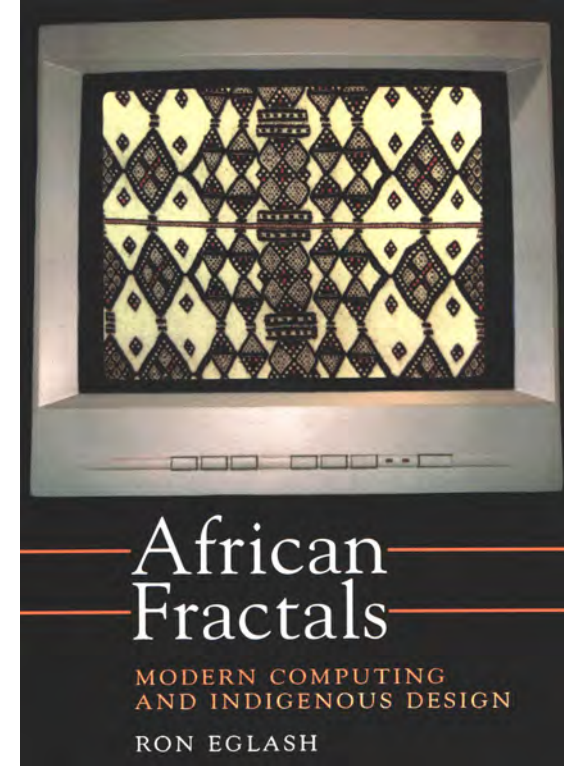
Geometric analysis of the ivory sculpture



So how can we apply
this in the classroom?

Culturally Situated Design

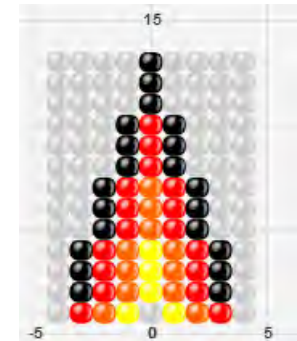
Tools: www.csdt.rpi.edu



Ethnocomputing with Culturally Situated Design Tools (CSDTs)

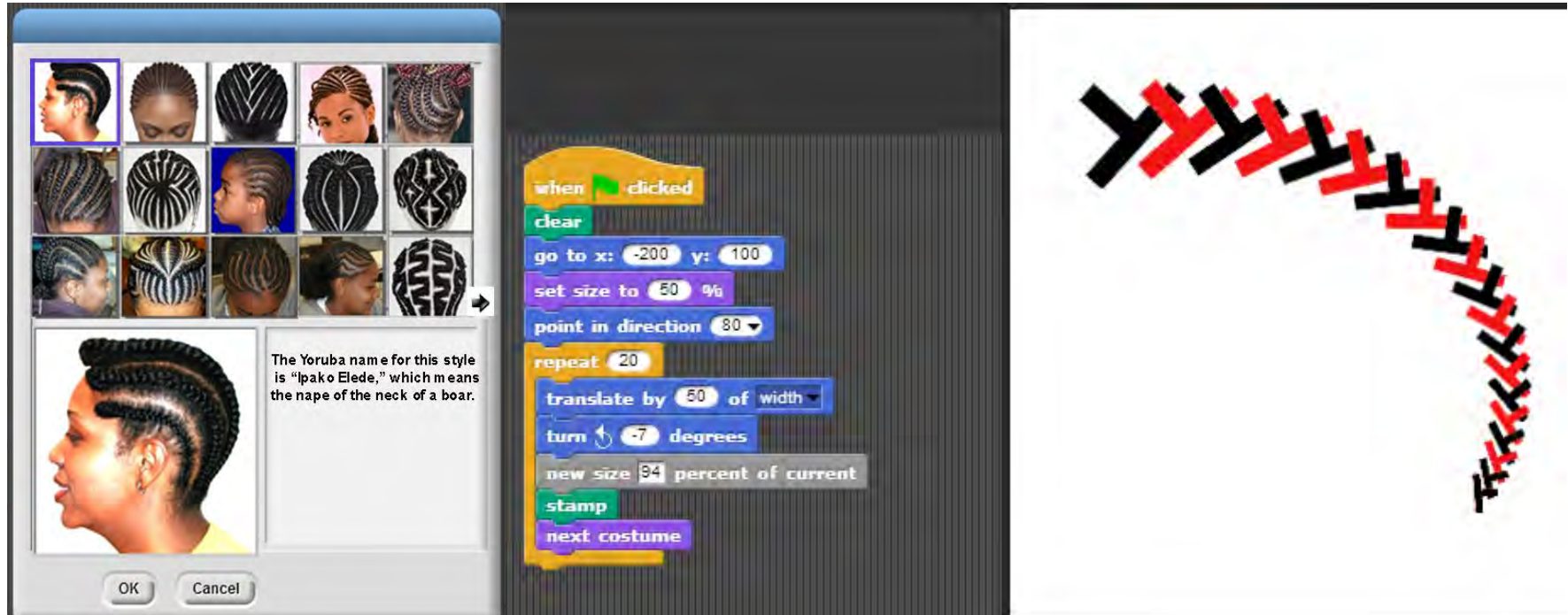
www.csdt.rpi.edu

1. Work with artisans, elders, others to ensure we have a basis for collaboration and “cultural permission” (not just a matter of copyright!)
2. Interview artisans and research cultural background to understand the knowledge system from their point of view (“emic” not “etic”).
3. Translate their practices and concepts into equivalents in CS (weaving algorithms, geometric transforms, power law scaling, anti-aliasing, context free grammars, etc.).
4. Embed these concepts in a “design tool” applet that allows students to simulate the original designs and create their own innovations



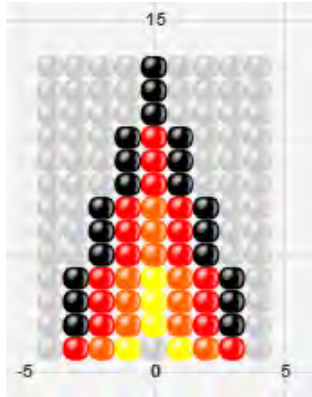
Scratch-like interface for CSDTs

<http://community.csd.t.rpi.edu/applications/9>

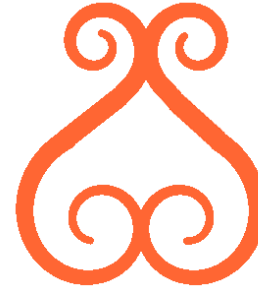


CSDTs: indigenous ethnocomputing

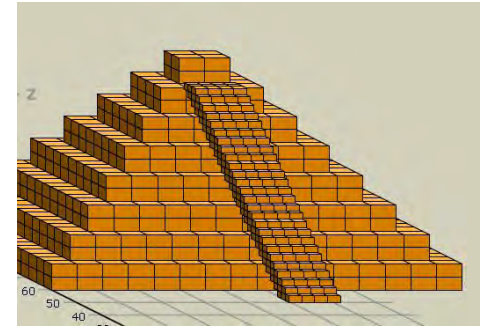
Virtual Beadloom



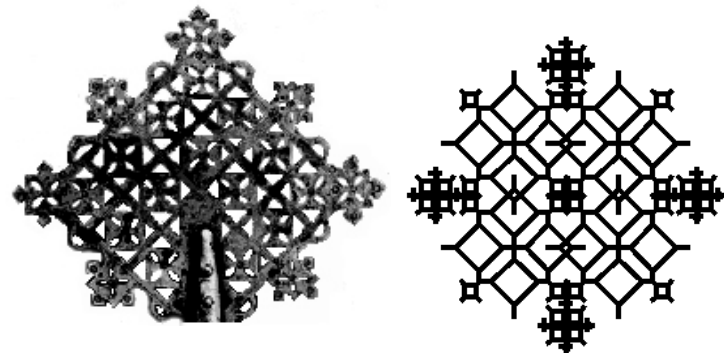
Adinkra Grapher



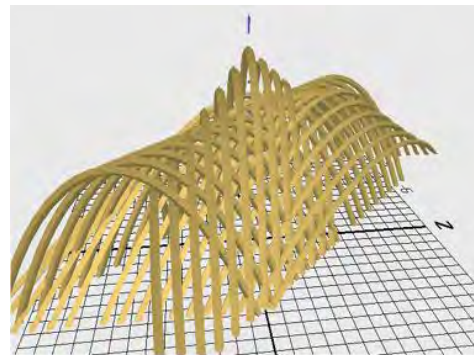
Precolumbian
Pyramids



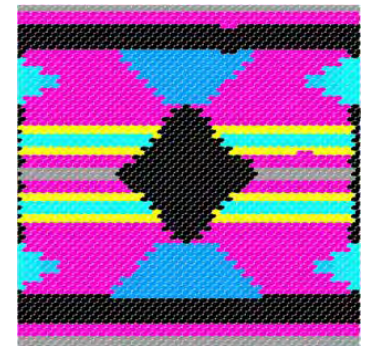
African Fractals



Anishinaabe Arcs

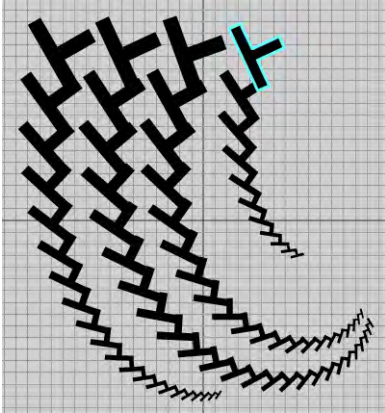


Navajo Weaver

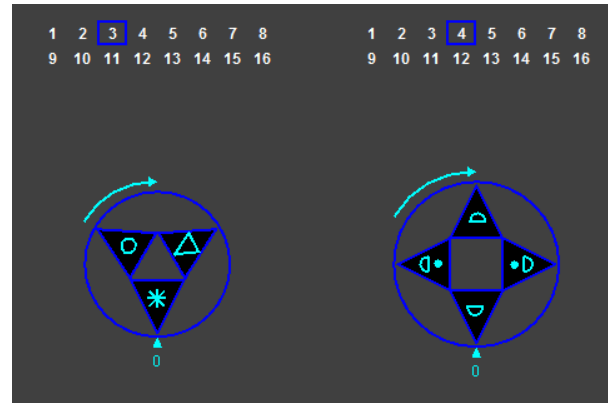


CSDTs: vernacular ethnocomputing

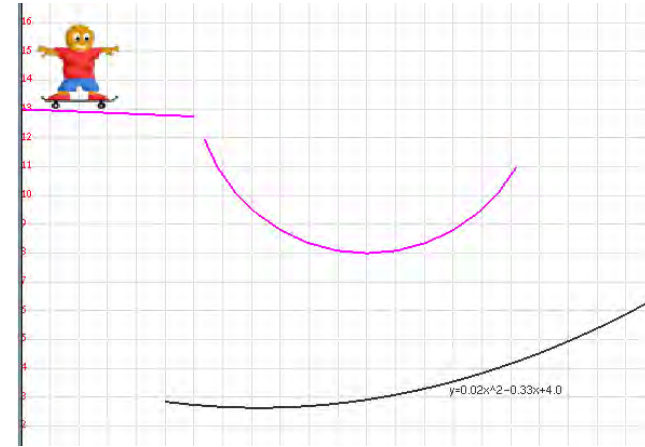
Cornrow curves



Rhythm Wheels



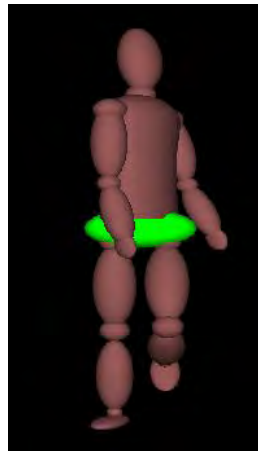
Skateboarder



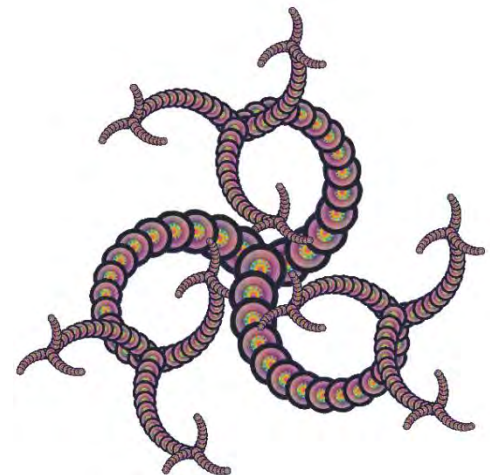
Graffiti Grapher



Breakdancer



Afrofuturism



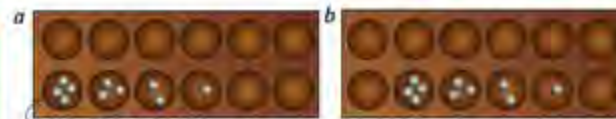
Fractal Simulations of African Design in Pre-College Computing Education

ACM Transactions on Computing Education, Volume 11, Issue 3, Oct 2011

- 10th grade computer science class, two sections.
- About 75% minority, over 50% female.
- Control class has 6 days on fractal instruction websites with java applets.
- Intervention class has 6 days on the African fractals website.
- Post-test shows higher scores in intervention group;
- statistically significant at .001 level

L'algorithmique ethnique

Beaucoup de traditions culturelles sont fondées
sur des algorithmes que l'on peut extraire de leur contexte
pour les utiliser à des fins pédagogiques auprès des minorités. **Ron EGLASH**



1. LA PLANCHE DU JEU D'AWALE est constituée de deux lignes de six compartiments. Pour jouer, saisissez le contenu d'un trou (ici, celui qui en contient quatre) et placez les pions dans chacun des trous suivants (a), à raison d'un pion par trou. Le « groupe de marche » est un « motif de pions » qui, après un tour de jeu ne fait que se décaler d'une case (b).



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Discrete Mathematics 308 (2008) 3694–3698

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Note

Periodical states and marching groups in a closed owari[☆]

Henning Bruhn

Mathematisches Seminar, Universität Hamburg, Bundesstraße 55, 20146 Hamburg, Germany

Received 7 February 2006; received in revised form 25 June 2007; accepted 5 July 2007

Available online 4 September 2007

Abstract

Owari is an old African game that consists of cyclically ordered pits that are filled with pebbles. In a sowing move all the pebbles are taken out of one pit and distributed one by one in subsequent pits. Repeated sowing will give rise to recurrent states of the owari. Bouchet studied such periodical states in an idealised setup, where there are infinitely many pits. We characterise periodical states in owaris with finitely many pits. Our result implies Bouchet's result.

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Social Justice and Science need a Symmetric Exchange

Society

Apply science and
technology to
problems in
social justice
and sustainability



Science

Use problems in
social justice
and
sustainability to
drive science
and innovation

Graduate Teaching Fellows in Community Situated Research: The Triple Helix of University, K-12, and Community Knowledge Production



Software entrepreneurship in Ghana



**Grad Fellow
Bill Babbitt
(CS):
Simulations
of cultural
processes**



**Community
artists and
elders**



**Grad
Fellow
Dan
Lyles (STS):
cultural
capital in
low-income
communities**



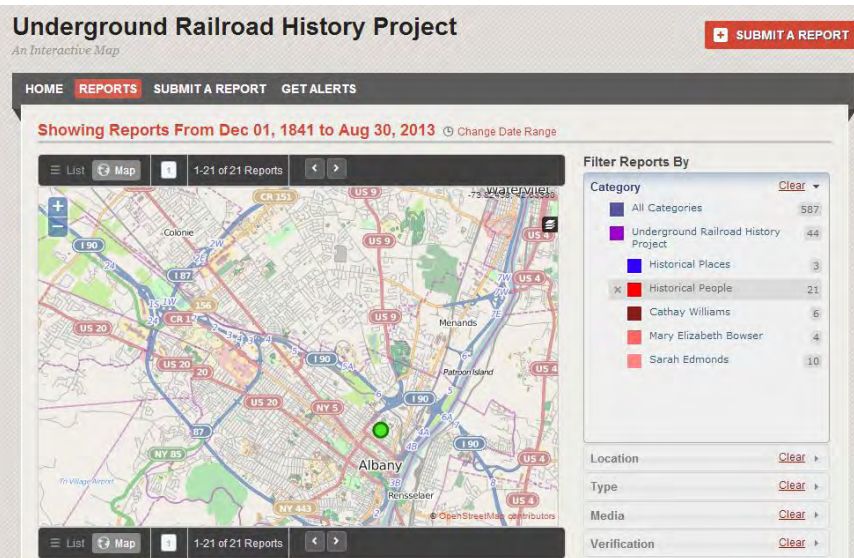
STEM abolitionist project




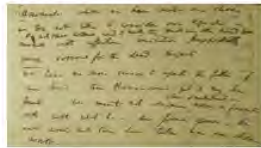
CS grad fellow
Kathryn Bennett
educational software



STS grad
fellow
Colin Garvey
History of
Evolution



GIS software for mapping local
sites for abolitionist history

Image	Rollover text	Helper's text linked from blue link
	<p>This medallion was created by Josiah Wedgwood. It was worn by members of the abolitionist society.</p>	<p>Josiah Wedgwood was the grandfather of Charles Darwin</p>
<p>Darwin's notebook B-231</p>  <p>http://darwin-online.org.uk/content/frameset?itemID=CUL-DAR121-&viewtype=side&pageseq=1</p>	<p>"Animals whom we have made our slaves we do not like to consider our equals. — Do not slave holders wish to make the black man other kind?"</p>	<p>Darwin was saying that the white master with a black slave has to have an excuse for treating someone so poorly. So they make up the idea that black people are a different species than whites. Not a true human, but an "other kind" of animal.</p>

Game for discovering Darwin's
abolitionist connections

Example: 3 grads collaborate on sensor device



Grad Fellow Chris Shing (ECSE): Nanoparticle-based sensors



GRA Kirk Jalbert (STS): Community Situated Sensing



Grad Fellow Louis Gutierrez (CS): Online data analysis for "Citizen Science."



Albany NY public schools

Navajo Nation Community College and high schools

Langui, Peru study of indoor air pollution

Ultraviolet Photodetection Based on ZnO Colloidal Nanoparticles Made by Top-down Wet-chemistry Synthesis Process

Liqiao Qin, Christopher Shing, Shayla Sawyer
Electrical, Computer, and Systems Engineering Department
Rensselaer Polytechnic Institute
Troy, NY 12180, USA
qinl@rpi.edu



Professor Shayla Sawyer

- 1) Nanosensors using inorganic molecules could detect Navajo uranium pollution but not for coal and oil (VOC) pollution
- 2) Sawyer paused – “come to think of it, no one has tried this—to use organic molecules in semiconductor photodetection”
- 3) This created a new research path: nano-bio materials in semiconductor photodetection
- 4) Later we brought in a grad Fellow whose faculty advisor Chris Bystroff was in biology; he “tunes” genetic sequences to detect specific biological molecules

Example: Grad, faculty, community collaborate on HIV awareness



Grad Fellow
David Banks
(STS): Mobile
technologies
in civic
sphere



Kumasi, Ghana
community
health
professionals



Prof.
Audrey
Bennett

(LL&C): visual
communication
for HIV
prevention



Condom machine sends text when it needs to be refilled. Users can text to find locations

Example: Grad, faculty, community collaborate on HIV awareness



Grad Fellow
David Banks
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technologies
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Kumasi, Ghana
community
health
professionals



Prof.
Audrey
Bennett
(LL&C): visual
communication
for HIV
prevention



SANKOFA

"you can always go
back to your roots"



"Wait honey, I have to
go back for my condom"

Example: Grad, faculty, community collaborate on HIV awareness



Grad Fellow
David Banks
(STS): Mobile
technologies
in civic
sphere



Kumasi, Ghana
community
health
professionals



Prof.
Audrey
Bennett
(LL&C): visual
communication
for HIV
prevention



Outcomes at year 4

1) Anti-relativist alternatives to social construction

Eglash, R. (2011) "Multiple objectivity: an anti-relativist approach to situated knowledge", *Kybernetes*, Vol. 40 Iss: 7/8, pp.995 – 1003

Eglash, R. (2013) "Towards a Cybernetics of Race: determinism and plasticity in ideological and biological systems." Pp. 57-82 in Hartigan, J. (ed) *Anthropology of Race: Genes, Biology, and Culture*. SAR Press 2013.

Eglash, R. (2013) *Fractal Flows in Upstream Engagement: Symmetric Innovation between Technoscience and Social Justice*. Society for Social Studies of Science, San Diego CA 2013.

Outcomes at year 4

2) Alternatives to socialism and liberalism

**Why assume that we already have our politics settled,
and only need to bring science and technology “into compliance”?**

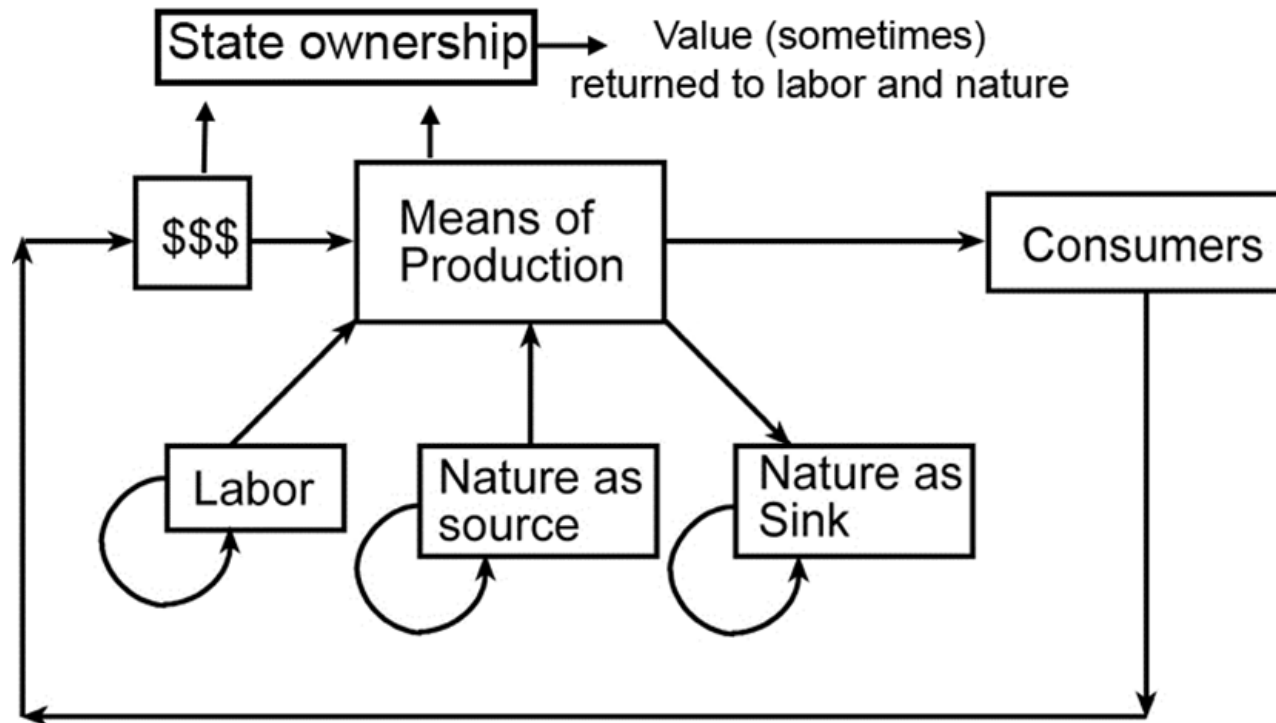
["Distinguishing Generative Justice and Distributive Justice"](#) (ppt for talk at the *Engineering, Social Justice, and Peace Conference*, Troy, New York, 14--16 August 2013).

["Generative Justice in Africa: From Fractals to the Rise of Maker Movements."](#)
Ellen Foster and Ron Eglash, *Think Africa Press*, March 27, 2014

Eglash, R and Garvey, C. ["Basins of Attraction for Generative Justice"](#) In Santo Banerjee, Sefika Sule Erçetin, and Ali Tekin (eds) *Chaos Theory in Politics*. Berlin: Springer, 2014.

Socialist solution: distributive social justice

- 1) Capitalism extracts self-generated value, creating injustice and alienation
- 2) Capitalism raises profits by "externalizing" costs, damaging health and environment



Ecological disasters in the USSR

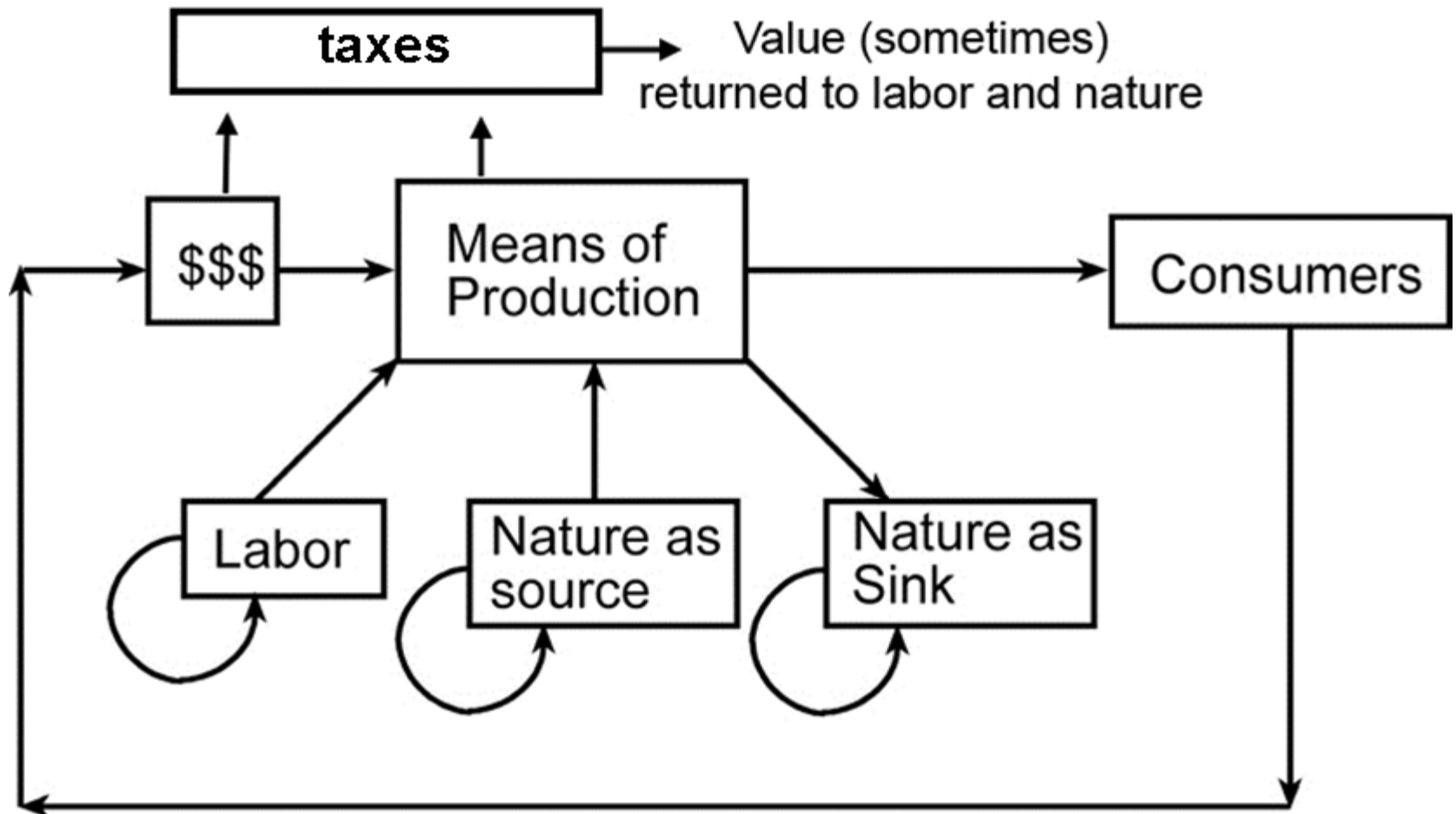


Above: Scarred landscape caused by overgrazing in USSR

Below: lush grazing land under indigenous Mongolian community control

Liberalism is also based on distributive social justice

- 1) Socialism attempts to return that surplus value by state ownership
- 2) Liberalism attempts to return that surplus value by taxes



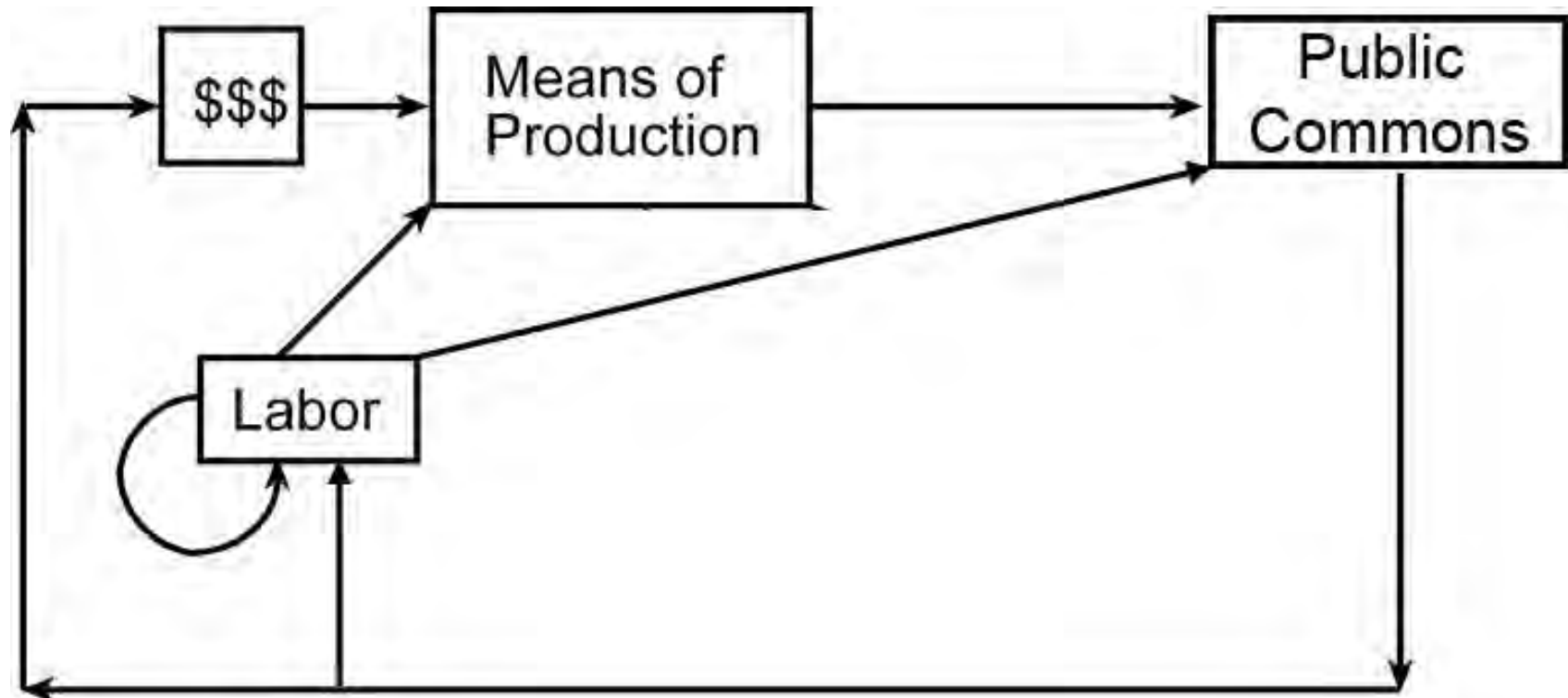
Confusion over social justice in the case of Open Source Software

Kevin Kelly is wrong: Open source software does not fit the category of “socialism”

Yet it is relevant to “social justice” – how do we resolve this contradiction?



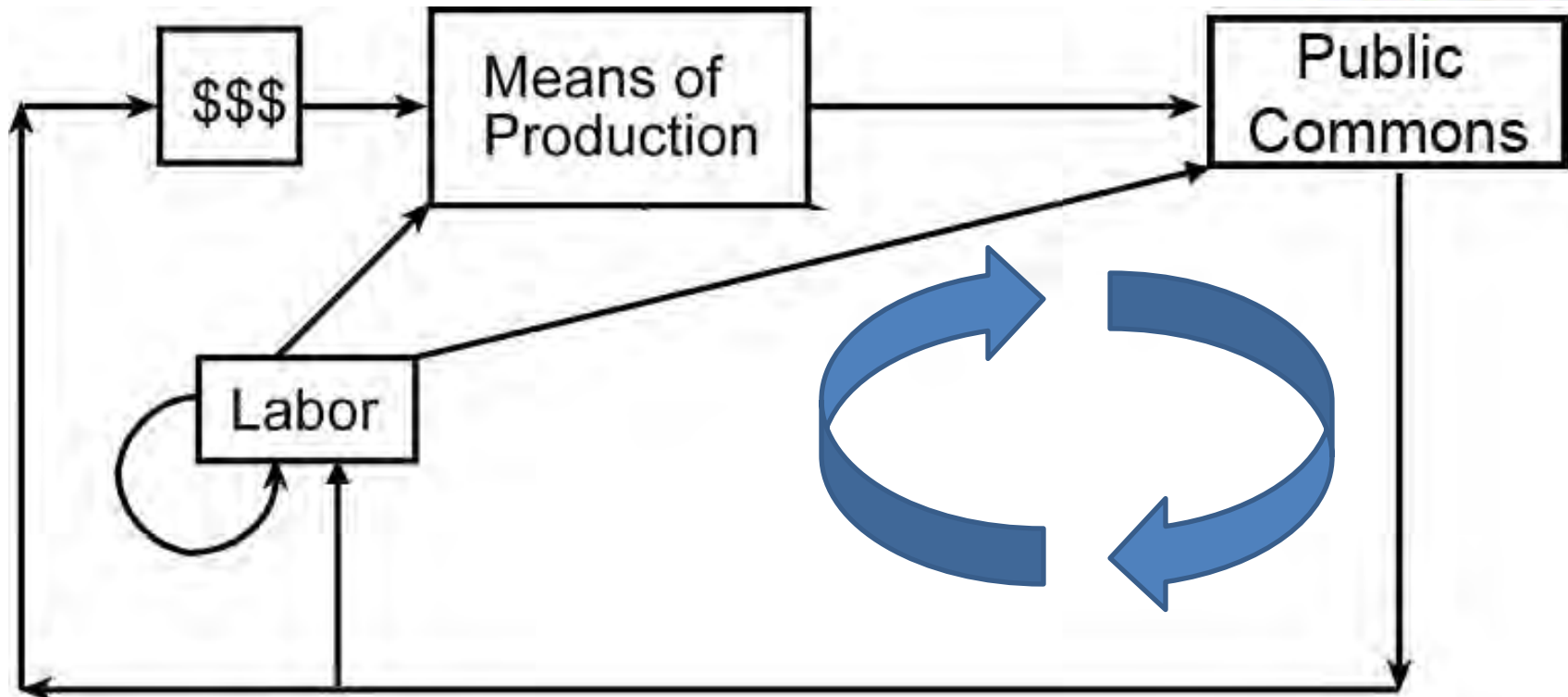
Open Source is a case of generative social justice



Generative justice reconfigures the flow of value: from labor back to labor

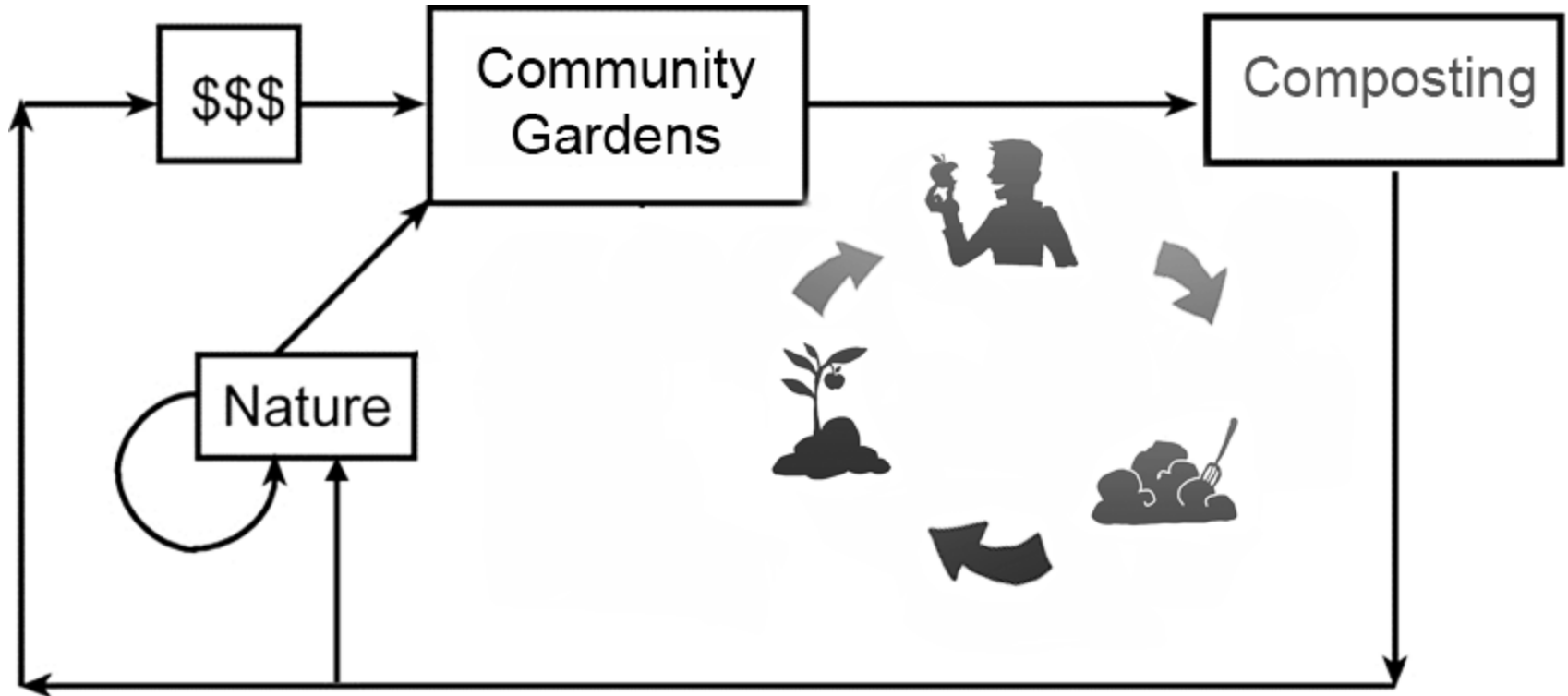
Previously the software developers labor value can be privatized (extracted)

But Open Source ensures that value is available to its source of generation via the public commons



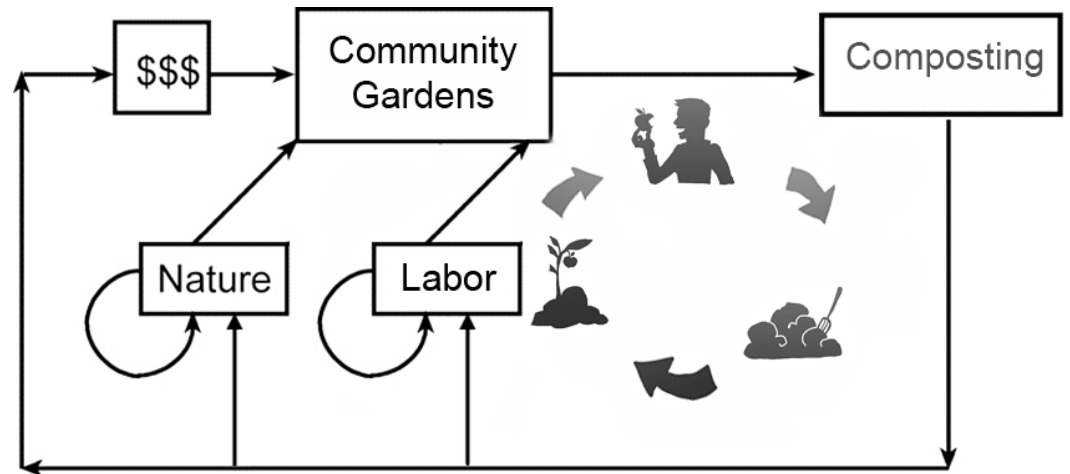
Generative justice reconfigures the flow of value: from nature back to nature

Previously nature's value can be privatized (extracted).
But Critical Growing (Lyles) ensures it is available to its via the natureculture commons.



Why should small scale waste recycling be better than large scale industrial waste systems?

Because the small-scale case offers greater opportunity for Generative justice



Generative social justice

Increasing the public capacity for self-generating practices and resources

Social entrepreneurship: capital at the service of social justice

Generative public spaces: Community gardens, murals

Generative technologies: DIY, Maker-faire, Arduino, fan fiction, citizen journalism

Generative educative practices: Recovering heritage, history, futures

Come to the Generative Justice Conference!



Generative Justice: Value from the Bottom-up

A conference at RPI, June 27-29 2014

Social problems are often addressed through the top-down forms of “distributive justice”: intervention from government agencies and regulations for example. But science and technology innovations have opened new possibilities for “generative justice”: bottom-up networks that strive for a more equitable and sustainable world through communitarian value generation. Some examples of generative justice involve lay innovation: maker spaces, DIY movements, and “appropriated” technologies. Other examples are more focused on nature as a generator of value, such as urban agriculture, food justice, and indigenous harvesting. Some focus on the framework of Open Source, putting code, blueprints and manufacturing processes into the public domain. Generative justice can apply to social entrepreneurship, restorative justice, community media, social solidarity economies, and many other structures that allow those who generate value to directly participate in its benefits, create their own conditions of production, and nurture sustainable paths for its circulation.

We invite presentation and panel proposals on the theory and practice of generative justice. What theories of ethics, law, epistemology and politics can help to define this concept and improve its utility? What research methods are best used to explore it, and in what analytic frameworks can it be deployed? Are the relations between distributive and generative justice best viewed as opposite ends of a continuum? As mutually supportive symbiosis? How might generative justice experiences and outcomes differ across identities such as race, gender, class, and sexual orientation; across geographic and national differences; across ideological and institutional spectrums? How can we distinguish generative justice from bottom-up forms of exploitation, oppression, or unsustainable ecologies? What kinds of technologies and scientific programs might foster more generative justice, and conversely, how might generative justice contribute to better STEM education, research, and infrastructure? (For more see the [Generative Justice wiki](#))

Please complete the form below to submit a proposal. Proposals will be considered through April 30, 2014.