AI for a Generative Economy: The Role of Intelligent Systems in Sustaining Unalienated Labor, Environment, and Society

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Abstract

Extractive economies pull value from a system without restoring it. Unsustainable extraction of ecological value includes over-fishing, clear-cut logging, etc. Extraction of labor value is similarly objectionable: assembly line jobs for example increase the likelyhood of cardiovascular disease, depression, suicide and other problems. Extraction of social value--vacuuming up online personal information, commodification of the public sphere, and so on-- constitutes a third form. But all three domains--ecological value, labor value, and social value--can thrive in unalienated forms if we can create a future of work that replaces extraction with generative cycles. AI is a key technology in developing these alternative economic forms. This paper describes some initial experiments with African, African American, and Native American artisans who were willing to experiment with the introduction of computational enhancements to their work. Following our report on these initial results, we map out a vision for how AI could scale up labor that sustains "heritage algorithms", ecologically situated value chains and other hybrid forms that prevent value alienation while flourishing from its robust circulation.

Keywords: human-machine collaboration; artisanal economy; generative justice; industrial symbiosis; ethnocomputing

1. Introduction

Questions such as “what jobs will remain after AI is sufficiently advanced” are implying a rather passive stance. True, the potential disruptions created by AI can cause trepidation. But they are also an opportunity for re-fashioning the future of work in ways that optimize environmental sustainability, sustain enjoyable labor, and enhance the public sphere. In the experiments described in this paper we investigate artisanal labor as the basis for such forms. Traditional cultural forms of production such as Native American wood crafting often embody all three domains: harvesting practices that are ecologically sustainable; labor practices that are deeply satisfying; and social networks in which both equity and creative expression can flourish (Ostrom and Ahn 2009; Corntassel 2012; Eglash 2016a,b; Liu et al 2018). If AI and related automation technologies can help to “translate” these forms into modes of production that fit contemporary needs and contexts, the social and environmental ills that were created by centuries of mass production--the extractive economy--could be addressed, and a generative economy--one in which value remains in an unalienated form; circulated rather than extracted--could be achieved.

In this paper we will briefly review the problems created by mass production, and the principles of generative economies in their traditional form. We then present some initial experiments with what we might term “artisanal cyborgs” -- a synthesis between traditional work practices and contemporary automation technologies. We conclude with a vision for how this research trajectory could enable the development of computational forms that merge artificial intelligence with a generative economy.

2. Social and environmental destruction in the mass production economy

Collaborative robots (“cobots”), where humans and robots work together side by side, are often proposed as a potential solution to the fear of massive job losses due to automation; the emphasis is on their ability to accomplish shared work goals (Colgate et al. 1996; Peshkin and Colgate 1999; You et al. 2018). But these goals are typically those of the mass production economy. Amplifying them with AI is not addressing the three problems that value extraction creates.

a. Alienation of labor value: monotony, limited worker agency, and a failure to allow a sense of pride in the fruits of our activity are typical of mass production. These are correlated with cardiovascular disease (Karasek et al 1981); work-related depression (Michelsen and Bildt, 2003); suicide (Woo and Postolache 2011), and other disorders.

b. Alienation of ecological value: millions of tons of plastic are entering the ocean annually; and heavy metals, pesticides, cleaning agents, organochlorides, and other toxins continue increasingly contaminate land and air (Kannan 1991; Jambeck et al 2015; Coccia 2017). Global warming; ocean acidification; and mass extinction (Vallero 2015; de Souza Machado, 2016; Dirzo et al 2014) are all consequences of mass production in an extractive economy.

c. Alienation of social value: mass production creates a demand for mass consumption. Increasingly AI is applied in the development of consumption accelerating techniques: adware, spyware, targeted social media marketing, and so on. Rather than satisfying needs, purchases in this “hedonic treadmill” *increase* buying aspirations (Chancellor and Lyubomirsky 2011). Consumption-driven social media platforms are linked to loneliness and depression (Hunt et al

2018); focus onto extrinsic rather than intrinsic goals (Kasser and Ryan 1996); and a decrease in academic achievement for consumption-obsessed youth (Bunce et al 2017).

A typical objection to proposals for a generative economy is that artisanal production--especially that tied to ecologically sustainable sources-- is incapable of generating the massive streams of consumer goods we currently produce. That is precisely the point: a generative economy, empowered by AI and other automation forms, would be decreasing social alienation, and (in a bi-directional, co-evolutionary process) decreasing consumer demand. In short: *with more meaningful forms of production comes less need to find meaning in consumption*.

3. The principles of generative justice

The phrase “alienated labor value” comes from Marx (1844); to fully understand that concept, we need to clarify the word “alienated”. Today that is interpreted as a psychological condition, “I feel alienated”. But Marx was using the word to mean “something that has been taken from you”. Marx and Engles had carefully read von Helmholtz, Carnot, Boltzmann and others in the new science of thermodynamics (Bellamy and Burkett 2008), and accordingly reconceptualized work in terms of “labor power”. Thus “alienation of labor value” was analogous to energy transfer in their framework: from the original source of energy generation (people) to somewhere else (capital). This labor value could then be stored (banks) and repurposed (capital investments in machines). By moving extracted value to the communist state, a utopian society would be born.

This vision for a top-down technocratic communism utterly failed, creating poverty, human rights abuse and environmental destruction to rival that of capitalism (Graham 1993; Peterson 2019). That is because both centralized communism and corporate capitalism depend on the same extractive modes of production (figure 1). Whether the “owner” is state or corporate is irrelevant. The self-generating source of value in Nature, Labor, and Social expression is reduced to “resources”.

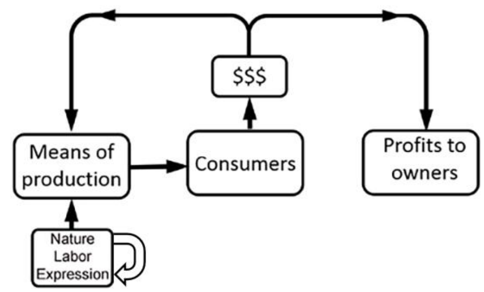

Figure 1: Extractive modes of production

Note that at bottom, the self-generating character of nature, labor and society is shown as a looping pipe. Nature attempts to sustain itself even if overharvested; labor replenishes itself at home even if the factory drains it; society maintains communication even if privacy is violated. But that value is extracted and carried off elsewhere. In contrast, Indigeous societies (figure 2) *keep value in unalienated forms*: the network is all pipe! Value generation is under control of the generators. A traditional artisan can take pride in her craft; maintain respectful two-way exchanges with nature, and relish a social network of solidarity and creative expression.

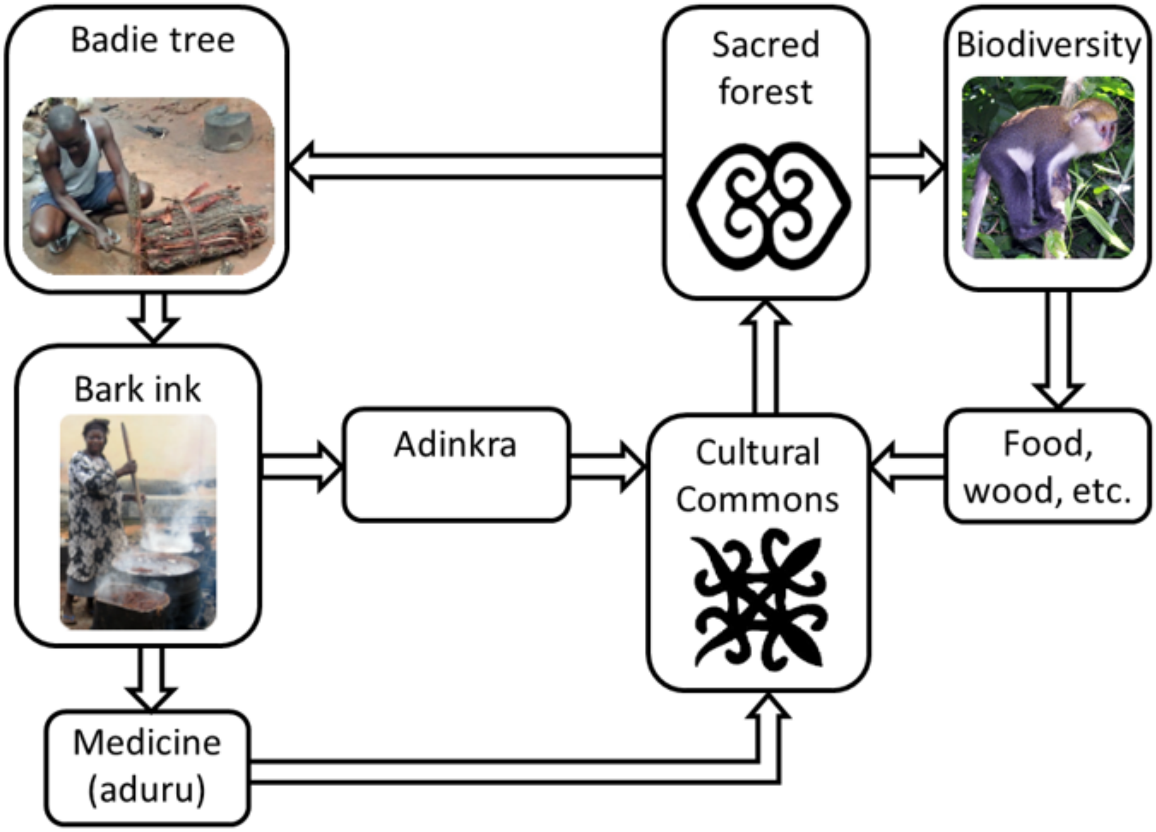

Figure 2 shows how Adinkra textile production in Ghana begins with Badie tree bark. Soaking bark in water produces an anti-dysentery medication ("aduru"), and is available in the commons to anyone. Further cooking the bark produces ink, which creates the adinkra symbols for "sharing" (two crocodiles who have the same stomach need not fight over food), and "earth in balance" (log spirals representing things in nature). Bark drained of its tannins is sent back to nature as compost. The sacred forest is small, but maintains a "hot spot" of biodiversity that feeds other areas, where the Badie tree grows. The value circulates in ways that are highly productive but have little alienation.

4. Initial experiments in artisanal cyborgs

Figure 3 shows our experiment with Ghanaian textile makers using a batik wax-resist method. The latex sponges they used were not compostable, so a trash heap of used sponges was growing. We had already created simulations of adinkra symbols, and shown statistically significant improvement for students learning math and computing through this indigenous knowledge (Babbitt et al 2015). So it was a simple matter to extend that to a 3D printed mold in which we grew mushroom-based foam. This merger of traditional artisanal practice and computational modeling is only the first step. By replacing wood fires with solar heat to produce inks and waxes; monitoring forests via GIS to prevent over-harvesting of Badie tree bark; bringing in additional sustainable and locally owned plant harvests (e.g. the coconut husk building materials in Lokko and Eglash 2017), a network of physical computing can both monitor and optimize these generative systems, leveraging traditional sustainability and equity with contemporary innovation.

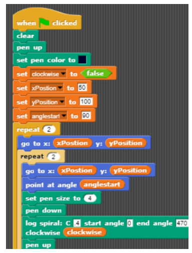

Figure 3: from Indigenous geometric form, to code, to 3D print, to mycofoam stamp

Further experiments yielded similar opportunities (Eglash et al. forthcoming; Lachney et al. forthcoming). In the case of African American braiding salons, these “heritage algorithms” were used for STEM education (Lachney et al 2018), and later rendered by 3D printing into store mannequin heads (figure 4). However the 2D patterns produced by students did not map neatly onto the heads; AI is currently being investigated as a possible means to automate what our postdocs have been doing by human expertise. Finally, in the case of Native American artisans, their use of parabolic arcs (wigwaams, canoe ribs, etc.) provided the heritage algorithm. But unlike the African American case, Native American students insisted on hand crafting the fibers to board with holes determined by the simulation they made. The African American hair stylists went on to investigate healthier hair products, testing locally produced plant products with digital pH meters. The Native American group extended the experiments into the use of arcs to create an aquaponics system, also with computational monitoring of water, fish and plant conditions. In both cases, like the Ghanaian textiles, the potential clearly exists for using AI to help the next generation sustain and innovate with heritage algorithms, bringing value back to those who generate it, and building those computation links out into generative network with reciprocal relations to nature, labor and society.

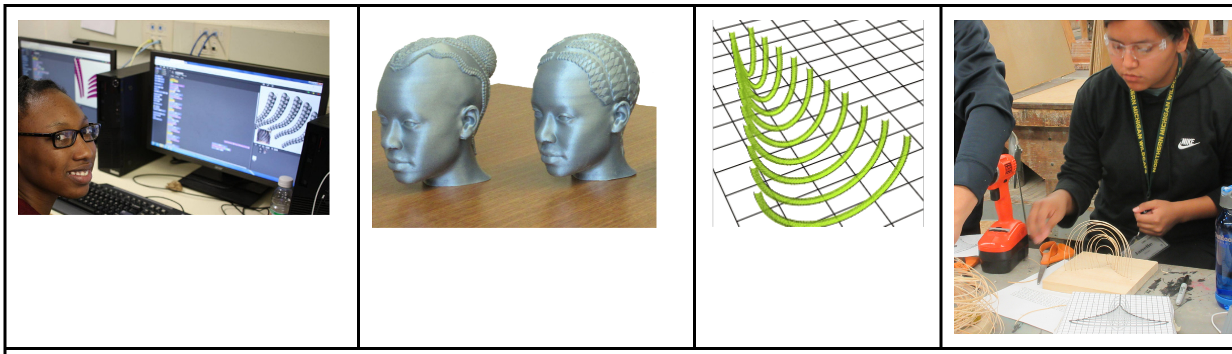

Figure 4: African American and Native American students merging traditional and computational crafting

5. Analysis

Gombolay et al (2015) conducted experiments on automating mass production. They reported that workers preferred to ceed task control to automated machines. Our experiments with African American, African, and Native American artisans in human-machine collaboration traditions (Eglash et al. forthcoming; Lachney et al. forthcoming) show distinctly different preferences depending on the context.

6. Conclusion

Artisanal labor, in a careful synthesis with AI, robotics and other automation technologies, could potentially help to democratize the economy, improve environmental sustainability, and allow lifeways that find more meaning and satisfaction in creative production than mindless consumption. AI has the potential to aid us in replacing extraction with a generative network in which value circulates in unalienated forms: hence the need for “artisanal cyborgs” that can scale up these generative alternatives.

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