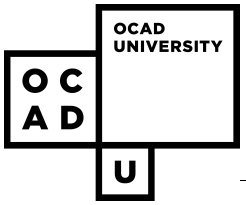

2018

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RSD7 2018
Relating Systems Thinking and Design Symposium 2018
www.systemic-design.net
WORKING PAPER

Systemic Design and Its Discontents: Designing for Emergence & Accountability

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Abstract

Systemic design holds promise to address grand challenges such as the United Nations Sustainable Development Goals. Toward these ends, we argue that the systemic design mindset needs better awareness and norms for accountability. We recommend greater use of knowledge from psychology to bring insight about motivations and cognitive biases. We call on systemic designers to integrate principles of ethical practice, as new technological affordances, which amplify risk, increasingly impact social and economic life. To highlight wanted and unwanted emergent effects in complex techno-social systems, we introducing a schema with three layers of activity: regulating, building, and using. To illustrate the risks and benefits of designing in a data-intensive world, we unpack exemplary cases from history and contemporary society. We highlight emerging initiatives where systemic design thinkers introduce ethical accountability to a system by cross-pollinating and collaborating between the three layers of activity with respect to these complex systems.

Keywords: design, ethics, psychology, responsibility, systems

1. Introduction

The aim of this paper is to better prepare systemic design to realize its potential to address complex problems. We seek to advance the role of systemic design in enabling communities to flourish, as represented in the United Nations' Sustainable Development Goals (UN SDGs). Given this high potential for impact, what are the ethical implications of moving up through the orders of design? As systemic design needs to balance its ambition with humility and ethical commitment, we ask: How might we lead systemic design toward more self-awareness, care, and responsibility?

We observe that systemic design is not the output from a group of self-identifying practitioners but may be understood as a mindset. A code of conduct for a single profession will not encompass all the people making impactful design decisions everyday, who may or may not identify as systemic designers. Our paper explores alternative pathways to bringing awareness and ethics to systemic design activities.

We introduce a simple model that looks at system activities across three layers: regulating; building; and using. We argue that psychological dimensions of actors in the system are important to consider across all three layers. We identify new conditions including systemic effects arising from the interactions given the unprecedented scale of contemporary systems. To promote hindsight and insight, we reference cases from history as well as from contemporary society, highlighting technological amplification as a factor for increased risks and benefits.

How might we unlock the promise of systemic design while mitigating its inherent risks?

- Recommit to holism
- Acknowledge emergence while promoting accountability
- Take up explicit knowledge from the field of psychology
- Embrace ethics and move from "Can we...?" to "Should we...?"

Toward these ends we examine recent developments at the intersection of democracy, social media, and artificial intelligence. This work seeks to shed light on potentially manipulative techniques at the intersection of choice, persuasion, influence, politics, and other nonlinear societal forces.

2. When Complexity is Exponential

What are the ethical implications of moving up the Four Orders of Design (Buchanan, 2001)? Over the last two decades, 'design thinking' has gained increasing recognition. We are seeing the rise of a new kind of design, ready to take a lead role in addressing complex problems at the level of UN SDGs, such as boosting gender equality, wellbeing, social justice, and social innovation. Design's expanded reach and dematerialization is noted by Bruno Latour, who states: "…the typically modernist divide between materiality on the one hand and design on the other is slowly being dissolved away. The more objects are turned into things – that is, the more matters of facts are turned into matters of concern – the more they are rendered into objects of design through and through" (Latour, 2008). At

the fourth order of design, systemic design is concerned with the design material of relationships and interactions among diverse systems components. At this level, there is high potential for risks as well as benefits, which can translate to unintended consequences as well as impact.

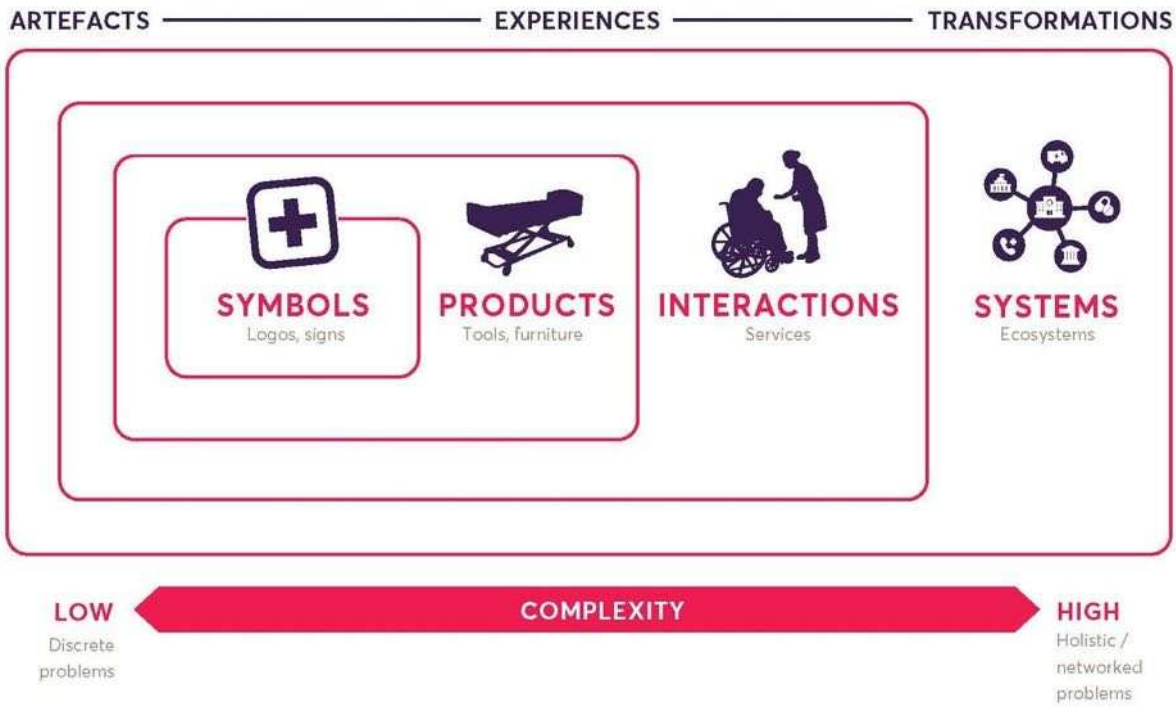

Figure 1. Four Orders of Design, based on Buchanan, 2001, in Leurs & Roberts, 2018.

Astute observers have pointed out that impactful decisions are being made every day by designers. For Latayna Sweeney, Director of the Data Privacy Lab at Harvard, "Technology designers are the new policymakers and AI is the new policy. No one elected these designers, and most people do not know their names, but the decisions they make ... dictate the code by which we conduct our daily lives and govern our country" (Sweeney, 2018).

We introduce this simple illustrative model that delineates system activities across three layers:

- Regulating
- Building
- Using

3. Systemic Design is a Mindset.

Systemic design may be understood as an interdisciplinary synthesis of systems theory and human-centered design (HCD). Alex Ryan describes systemic design as a "new space for harnessing dynamic complexity as a generator of innovation and value creation" (Ryan 2016). Systemic design

does not espouse the total design of entire systems; it marks a decisive pivot away from modernism toward 'designing for emergence' (Van Alstyne & Logan, 2007). In systemic design *we do not design systems, we design pathways through systems* (RSD6 audience, 2017).

Hallmarks of the systemic design approach we wish to avocate include working from a normative values basis, using co-design and inclusive participation, while anticipating and mitigating risks and unintended consequences, guided by stringent criteria such as Ashby's Law of Requisite Variety (Ashby 1958).

Ryan argues that systemic design is a *mindset* — a set of values and habits:

> The systemic design mindset describes a set of values and habits.... Both values and habits share the characteristics of being resistant to change and slow to change. The systemic design mindset cannot be taught directly. It is only through repeated systemic design experiences that individuals can, through reflection and behaviour modification, choose to enact new values and form new habits.

To fulfill the ambitions of systemic design, we want to pose the question of whether norms of participatory, human-centered design are effective and sufficient, practically and ethically. Given the potential scale of impact, we propose the embedding of normative values from ethics into actionable principles that mitigate risks. We also recommend creating robustness on the behavioural front by gaining greater understanding of various actors' motivations and cognitive biases from the field of psychology.

What is needed are beneficial results that are measurably more effective (better services from the same designers); more ethical (inclusive of representative data and perspectives from domains impacted by the design); and less risky (subject to due diligence through broader end-user participation and direct observation).

4. Risk and the Wisdom of Hindsight

To better understand systemic design's inherent risks, and establish historical and critical context, we ground this inquiry with reference to influential twentieth century conceptions of management and public relations.

Frederick Winslow Taylor's Principles of Scientific Management prescribes systemization, codification, and subdivision of all work tasks, to the extent of having individual tasks (Taylor 1911, 36–37). Even laying a single brick is deconstructed and re-designed scientifically by engineers, rather than bricklayers practicing trades of long tradition (Taylor, 1911, 77–85). This marks the emergence of industrial engineering as a field of 'applied science'.

> The change from rule-of-thumb management to scientific management involves ... a complete change in the mental attitude of all the men in the shop toward their work and toward their employers. The physical improvements ... can be made comparatively quickly. But the change in the mental attitude and in the habits of the three hundred or more workmen can be brought about only through a long series of object-lessons, which finally demonstrates to each man the great advantage he will gain by heartily cooperating in his every-day work with the men in the management. (ibid., 100–1)

The 'great advantage' Taylor refers to includes shorter hours, higher pay, and reliable relationships between productivity, quality, and reward. Workers did not have to be *consulted* but they did have to be *convinced*, as conscious and rational agents. His "four great underlying principles of scientific management":

> *First.* The development of a true science. *Second.* The scientific selection of the workman. *Third.* His scientific education and development. *Fourth.* Intimate friendly cooperation between the management and the men. (ibid., 132)

The apparently odd fit between the top-down behaviourism implied by the first three principles and the congenial collaboration of the fourth implies a variant of what eventually became the sub-discipline of industrial psychology, and presages the contradictions of 'participatory action research'. Are Taylor's workers peers, experimental subjects, objects of passive study, or efficiently mobilized masses?

In another twentieth-century development, Freud's American nephew, Edward L. Bernays, honed the craft we know today as propaganda by rebranding it as public relations (PR). Bernays anticipated spaces and practices of persuasion including marketing and consumer psychology. His name has never been well known to the public, which is surprising considering his long shadow. In the early twentieth century Bernays pioneered forms of advertising without advertising: product placement. Bernays used this to 'solve problems' like selling cigarettes to women, calling them 'Torches of Freedom' to associate them with liberation. He provided a blueprint for industrial, design-fueled techniques of persuasion. In hindsight these works present an unsettling roadmap for risks and benefits of mass culture and communications.

Reviewing this work is critical to understanding the use and misuse of persuasion for social purposes. As a researcher and practitioner, Bernays developed experimental group psychology techniques. He found that emotions such as fear brings rapid results whereas rationality and facts drive persuasion much less. Bernays ideas are unsettling in their contemporary relevance as is his frank assertion that democracy requires guidance and constraint by a shadowy elite (Bernays 1928). Bernays describes 'engineering consent' as "Use of an engineering approach—that is, action based only on thorough knowledge of the situation and on the application of scientific principles and tried practices to the task of getting people to support ideas and programs" (Bernays, 1955).

Today we are experiencing disclosures that bear chilling resemblance to those of Bernays's time. UK firm Cambridge Analytica acquired data for some 50 million Facebook users and built psychographic profiles for micro-targeting manipulative election ads based on users' dispositions and vulnerabilities (Grassegger & Krogerus, 2017; Cadwalladr & Graham-Harrison, 2018). In rapid succession, similarly election gaming also took place in the Philippines (Curato, 2017). Serious

concerns are being raised about potential effects of China's social credit system with its centralized citizen reputation score (Chorzempa, Triolo & Sacks, 2018).

These events demonstrate negative risks for the democratic process from large-scale data-driven systems; such systems form the incentive infrastructure of the attention economy. Amazon founder Jeff Bezos recently described social media as "a confirmation bias machine" (Tiku, 2018). His metaphor points to the intersection of a social media company's desire to generate profits through ad sale revenue, a human's tendency to search for new evidence that confirms existing beliefs through the consumption of ads, and an algorithm's ability to show ads that a user is likely to engage with. This business model incentivizes algorithms to show 'relevant' content to a user that he or she is likely to agree with.

5. Designing with Emergence in Mind

This paper extends the theoretical framework, "Designing for Emergence" (Van Alstyne & Logan, 2007; Van Alstyne & Logan, 2016). Fostering social innovation and knowing how we might give rise to desirable state change within systems requires us to understand emergence -- bottom-up forces of 'morphogenesis' -- the creation of new forms. The first step is recognizing the design-emergence distinction which, unspoken in most modernist traditions, is becoming an explicit understanding in the systemic design mindset. This basic distinction may be stated as follows:

> [D]esign is characteristically a top-down process.... In contrast, emergence is a bottom-up process in which the components of the system self-organize through their interactions with each other without a singular, overarching intention. The designer is typically in control of the design process, whereas in emergence the components of the system do not control the outcome – they merely influence it through their mutual interactions with each other. (Van Alstyne & Logan, 2007)

In the case of systems change, a new state arises through a myriad of interactions among elements or components. Consider the following emergent forms: a state of mind arising from neurons firing in the brain; leadership of a jurisdiction following votes cast by the electorate; or market share dominance of a brand due to purchases made by consumers. Such a form is not the product of a design process because it is the net result of innumerable individual actions by agents, acting within a system with degrees of freedom as well as rules and constraints (Capra, 2002).

Through systemic design we can reach an understanding of why, how and when it is possible and necessary to design for emergence. This knowledge is already present in the systemic design community and expressing itself in different ways. One emergent quality that cannot be directly designed, but be *designed with* and *designed for*, is human experience. Liz Sanders states this succinctly: "There is no such thing as experience design. Experiencing is in people and you can't design it for someone else. You can, however, *design for experiencing* (Sanders, 2001, author's emphasis).

6. Unlocking the Promise of Systemic Design

Precaution in the Era of Emergence

Risk and uncertainty in science- and technology-rich arenas, particularly in European jurisprudence, have given rise to the *precautionary principle*. UNESCO defines the precautionary principle as follows:

> When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm. Morally unacceptable harm refers to harm to humans or the environment that is
>
> - threatening to human life or health, or
> - serious and effectively irreversible, or
> - inequitable to present or future generations, or
> - imposed without adequate consideration of the human rights of those affected. (COMEST, 2015)

This approach holds up desirable aims yet bears many of the hallmarks of top-down thinking. While assessment of prospects or good practice for the precautionary principle are outside the scope of this paper, we note that it is intended to play a role in the space of dynamic balance between benefits and harms that accompany powerful technologies. Wherever this principle is in effect it will have bearing on the issues we address here: questions of how and why to design with emergence in mind.

A Professional Oath of Practice May Not Be Sufficient

Well known to systemic designers is Herbert Simon's contention that "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones" (Simon 1988). Simon argues that "Design, so construed, is the core of all professional training: it is the principal mark that distinguishes the professions from the sciences. Schools of engineering, as well as schools architecture, business, education, law, and medicine, are centrally concerned with the process of design" (Simon, 1988). In such a condition, what we can we say about the "duty of care" that systemic design might need to adopt, for broader physical, social, and environmental impacts of design outcomes either in place or possible for designers? And where do we go from here? In this work we call on systemic design to:

- Reaffirm holism: willingness to engage in accounting for emergent qualities
- Take up explicit knowledge from the field of psychology: the science of feeling, thinking, deciding and behaving, working with bias as designers and as system actors
- Embrace ethics: explicit principles of right and wrong, and inclusive participation

Taking Up the Wisdom of Psychology

We note that psychology has successfully lent its wisdom to other disciplines. *Behavioural economics* is one pathway that has found significant value and traction. This subfield has been illuminated through captivating work that reveals biases (Kahneman & Tversky, 1974; Ariely, 2008). The approach has seen enthusiastic take up, especially by the public sector, through terms that include 'nudging' and 'choice architecture' (Thaler & Sunstein, 2008). Behavioural economics reintroduces highly recognizable human motivations and biases that had been omitted from the rationalist models of classical economics. In so doing this work has begat a more resilient and mature hybrid. We take encouragement from experiment and exploration in arenas that hold strong interest for systemic design: policy, governance, community development, economic cooperation, innovation.

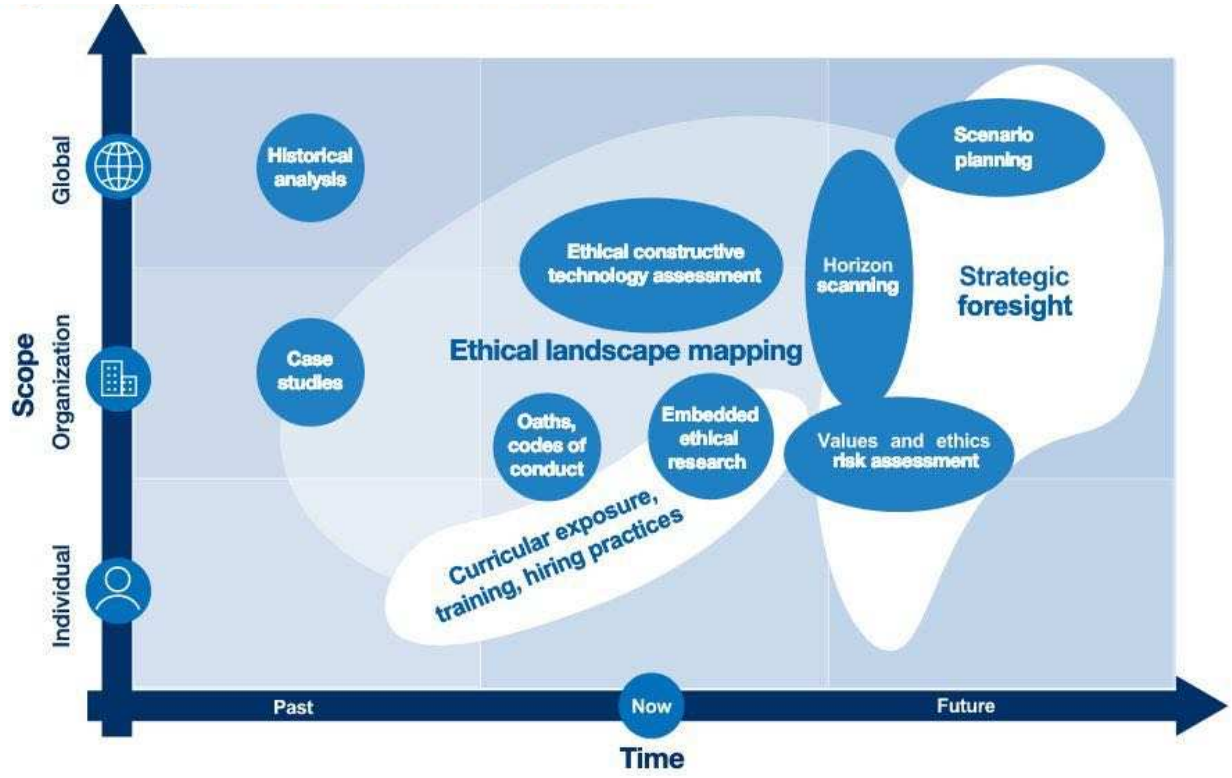

Figure 2. Mapping Values and Ethics Tools and Frameworks. Philbeck, T., Davis, N. & Engtoft Larsen, A. M. (2018)

Moving from "Can We?" to "Should We?"

> *Any machine constructed for the purpose of making decisions, if it does not possess the power of learning, will be completely literal-minded. Woe to us if we let it decide our conduct, unless we have previously examined the laws of its action, and know fully that its conduct will be carried out on principles acceptable to us!* (Wiener, 1950)

In a more urgent sense we see a need to stem and mitigate unwanted consequences arising from inadequate development and deployment of automated and augmented systems in which emergent dynamics play an inherent functional role as well as leading to potentially unsettling social and political effects. Working from first principles, Ryan articulates the "formulating" role of systemic design as a normative move that directly engages our shared values:

> Formulating shifts the focus of designing from understanding what is, to prescribing what ought to be.... Questions of what ought to be engage our values. As a normative activity, formulating should declare a reference system of values that the team seeks to enhance by acting within the situation. This should not be limited to the values of the team, but explicitly includes the values and interests of stakeholders (Ryan, 2014).

In an early contribution Liz Sanders (2001) asks a similar question: "Attention is shifting to the fuzzy front end of the design development process where the discussion is centered around questions such as "what should we make?" instead of "what should it look like?"

Emerging Initiatives

Opening Up Artificial Intelligence

OpenAI is a counterintuitive initiative that tries to bridge the gap between 'regulating' and 'using' and mitigate risk by building Artificial General Intelligence (AGI) through open collaborative research that "is free from financial obligations." OpenAI is a non-profit artificial intelligence research organization founded by Silicon Valley veterans Elon Musk of Tesla and Sam Altman of Y-Combinator. Its stated mission is long-term research to build safe AGI, and to ensure AGI's benefits are as widely and event distributed as possible (OpenAI, 2015).

On February 14, 2019, the organization gained extensive media attention for its groundbreaking unsupervised language model GPT-2. This is significant because the model was able to achieve "state-of-the-art performance on many language modeling benchmarks, and perform rudimentary reading comprehension, machine translation, question answering, and summarization -- all without task-specific training." (Better Language Models, 2019). OpenAI grappled with the societal implications of this discovery and decided to embrace responsible disclosure principles by not releasing the dataset, training code, or model weight, citing the clear potential for misuse through generation of "deceptive, biased, or abusive language at scale" (Better Language Models, 2019).

The Guardian experimented with the released smaller model, and to their astonishment, GPT-2 wrote a coherent article; performed tasks such as mimicking the author's tone; "wrote its own made-up quotes; structured its own paragraphs; added its own 'facts'" (Parkinson, 2019). Following OpenAI's cue, *The Guardian* decided to limit its release to *print only* for the similar fear of the digital amplification of mis-information.

Building Trust in Civic Data

Civic Data Trusts represent a novel approach to balancing stakeholder interests in data-intensive systems. The general problem is how best to provide for the management of data collected in and about patterns of human behaviour in the public realm, whether for commercial exploitation or to inform public sector service delivery and planning.

Civic data trust is also newsworthy as an initiative under consideration for Toronto's Waterfront, proposed in October 2018 by Sidewalk Labs, a Google affiliate with a contract to co-develop public spaces and services in Quayside development. The proposal describes an "independent entity to control, manage, and make publicly accessible all data that could reasonably be considered a public asset, and a set of rules that would apply to all entities operating in Quayside, including Sidewalk Labs. With the Data Trust, we move away from entities, including Sidewalk Labs, solely owning and controlling these assets" (Sidewalk Labs, 2018).

To be clear, a civic data trust is not necessarily an organ of a municipal government, or publicly held at any other level of the formal public sector. According to Open Data Institute's working definition, "A data trust is a legal structure that provides independent stewardship of data" (Hardinges & Wells, 2018). A civic data trust set up to handle the Quayside data would have to be designed not only to be technically competent to manage data and data licensing, but also to manage aspects of long term viability as an entity, including potential legal defenses, while remaining fiscally independent of its primary stakeholder, Sidewalk Labs. The design process is presently a matter of contract negotiations between representatives of Sidewalk Labs and the staff and trustees of Waterfront Toronto, disciplined by vocal contributions by local activists and media.

New Generations of Users Learning to Spend Time Well

From the perspective of empowering users, the first decade of the twenty-first century saw the rise of social media and rapid realization of benefits, including new awareness of how to design with emergence (O'Reilly, 2007; Van Alstyne and Logan, 2007). The second decade has demanded that we better understand risks and unintended consequences. Looking at the work of Tristan Harris is illustrative here. After working in B. J. Fogg's Persuasive Technology Lab where he studied the psychology of behavior change, Harris founded a company that was acquired by Google in 2011. Harris became increasingly concerned with the distracting and addicting qualities of smartphones and related systems, and through his efforts there became known as Google's 'Design Ethicist'.

Harris has since left to found the not-for-profit Center for Humane Technology to promote mindful reform under the banner "Time Well Spent" (Harris, 2016). Harris is working in partnership with Common Sense Media, a 15-year-old non-profit organization that has built trust through advice and advocacy to families promoting safe technology and media for children. A related effort in Europe asks, How might we teach people critical and ethical competencies such as how to spot fake news? Italy's speaker of the House Laura Boldrini is also working on this question. Italy is now teaching

media literacy in eight thousand Italian high schools (Livesay, 2017). These optimistic developments are about building awareness and educating young people.

7. Conclusion

Learning to design with emergence in mind calls for new design principles. We present the following as work in progress for further consideration and discussion:

Principles for Designing with Emergence	
• Relinquish total control • Balance creativity & stability • Acknowledge parasitism & hacking • Give up 'strong derivability'	• Understand people • Understand latent & blatant bias • Nothing about us without us • Ethical by design

The purpose and process we are advocating for the systemic design community is to advance our maturity and thereby our positive impact for the many, not the few. In other words, we want to learn to act more responsively and responsibly, to do *both* risk-taking and risk-management. In explicitly seeking integration of values and habits, in other words, by maturing and integrating itself as a field of practice we see opportunity and responsibility for the project of systemic design to become more deeply intertwined with ethics and psychology.

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