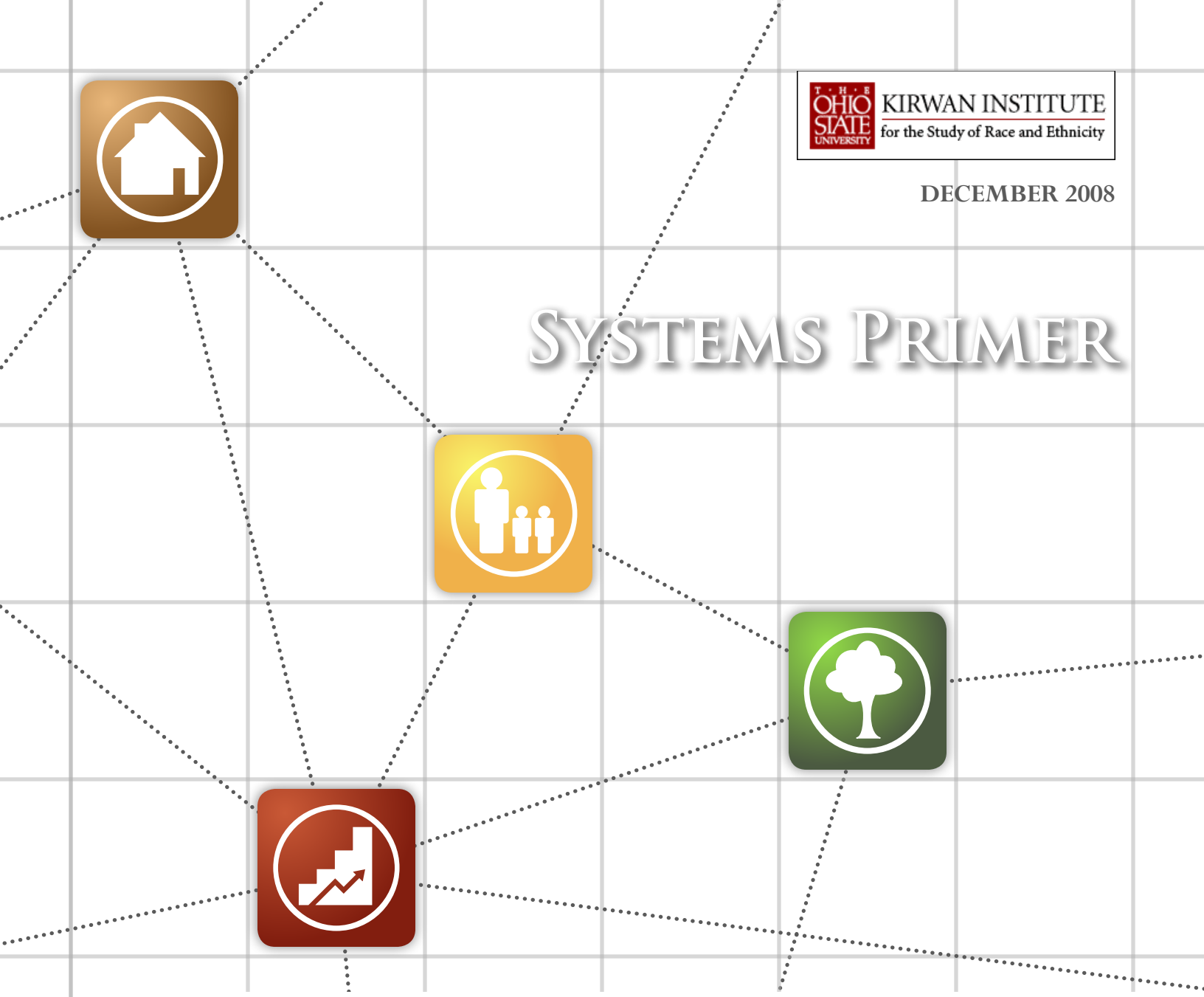

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Systems Primer

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The **Kirwan Institute for the Study of Race and Ethnicity** is a university-wide interdisciplinary research institute. We generate and support innovative analyses that improve understanding of the dynamics that underlie racial marginality and undermine full and fair democratic practices throughout Ohio, the United States, and the global community. Responsive to real-world needs, our work informs policies and practices that produce equitable changes in those dynamics.

Systems Thinking and Race

By Stephen Menendian and Caitlin Watt[1]

As we struggle to make sense of changes to our environment, as health care workers try to anticipate the possible spread of infectious diseases across the globe such as avian flu, or resistance to treatments within the human body, as politicians and policymakers grapple with the impacts of globalization, including the foreclosure crisis and its sweep through the global economy, they are all coming to the conclusion that the conventional ways of thinking about these problems are inadequate. The behavior of complex systems is not comprehensible by searching for single causes or by trying to reduce problems into their separate components for individual analysis and resolution. This realization has led to a new approach to knowledge and causality that is increasingly being applied in many fields, from organizational management to cybernetics. This new approach is called systems theory, or more accurately, systems thinking. A system is defined as an interdependent group of agents working together as a whole. The agents "might be the atoms that interact to form a molecule; the bones, organs, and tissues that constitute the human body; the sun and planets that together form the solar system; or the police, lawyers, judges, courts, prisons, and computer programs that together make up the 'criminal justice system.'"[2]

This chapter will set out five fundamental principles of systems theory that inform our understanding of contemporary racial conditions. Systems theory is not a theory proper, but rather a set of principles that make the dynamics and patterns of system behavior intelligible. It is a different way of looking at the world, a perspective that sheds light on relationships and interactions that are often overlooked within a linear, reductionist frame of reference.[3] This approach provides decision makers with the tools to respond to and cope with unforeseen obstacles that inevitably arise in complex systems.

We employ systems theory as a framework to help us better understand the production of racial inequality today. By using systems as the unit of analysis we can both visualize and understand the degree to which, and means by which, the organization of agents within a system shapes very important results. Systems theory rejects a reductionist approach and recognizes that the explanation for certain racialized outcomes is found in the system's structure itself. By allowing us to break out of a linear, cause-and-effect frame we can construct and conceptualize the interactions and interconnections within structures that yield racialized results. Systems thinking is not intended to be a panacea to entrenched problems, but is instead a perspective from which we can better understand how to design solutions and craft effective interventions to challenge these processes.

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[2] Lynn M. LoPucki, *The Systems Approach to Law*, 82 Cornell L. Rev. 479, 482 (1996-1997). The definition of a system varies from author to author. We adopt a comparatively simple definition here since we feel that many of the additional definitional elements often given are insights of systems behavior rather than definitional in nature. *See* ROBERT JERVIS, SYSTEMS EFFECTS: COMPLEXITY IN POLITICAL AND SOCIAL LIFE 6 (1997).

[3] Systems theory is a paradigm with a different philosophical lineage and a different set of assumptions about knowing. The contrast is sometimes drawn between Newtonian science and Quantum physics, with the latter having parallel assumptions about the impact of the observer, the dynamic, evolving nature of reality, interconnectedness, and the appropriate unit of analysis being relationships rather than parts.

I. The Structure of a System is as Important as its Parts

All systems have a structure, and those structures matter. It is the organization and relationships between a system's parts as much as the components themselves that shapes system outcomes and system behavior. Consequently, systems thinking is a rejection of reductionism, a characteristic of analytical reasoning, which seeks to understand system outcomes by breaking the system down into its component parts as a way of understanding the whole. Systems behavior is different from the sum of its parts, and does not follow from intentions of the individual agents, but on how system agents are interacting with each other within the system structure.

The tendency in any social and so-called 'hard' sciences is to seek to understand outcomes through analysis. Analytical reasoning is a process that assumes that outcomes can be understood by reducing things into their component parts and studying those parts individually. Isaac Newton believed that if one knew everything about each individual component of the universe, one would be able to understand and predict the trajectory of the components, a feature of the 'clockwork universe.' In econometrics, quantitative regression analysis separates many factors out in an attempt to understand causal patterns by identifying high correlations and ignoring those factors that do not produce a strong correlation.

Reductionism, a characteristic of analysis, is a process of breaking a system down into its component parts as a way of understanding the whole. To an economist, for instance, total or aggregate demand is merely the sum of individual demand. All one has to know are the individual demand curves to create a total demand function. Accordingly, analysis and the process of reductionism assume that a system is merely the sum of its parts, that it is summative. A saying attributed to Margaret Thatcher goes, "you get a responsible society when you get responsible individuals."[4] In other words, if citizens possess the quality of being "responsible," the society will possess that quality as well. Since reductionism focuses its attention on the agents or parts of a system, it also emphasizes the individual characteristics, behavior, and intentions of a system's agents in trying to understand system outcomes. This contributes to what is called the fundamental attribution error. This is the strong tendency to attribute the behavior or success of others to dispositional (internal) factors such as their intelligence, drive, intentions, preferences and power rather than situational (external) factors such as their place of birth, the society into which they were born, the opportunities they enjoyed, and their environment.[5]

Systems theory rejects a reductionist approach to understanding the behavior of a system. Systems thinking is a perspective that emphasizes the role of the system as a whole in shaping behavior and producing outcomes. By seeing things in terms of relational wholes and by using the system itself as the unit of analysis rather than simply focusing on the parts, we can better understand system outcomes and the role of the system's structure in producing those outcomes.

From a systems thinking perspective, system outcomes are non-summative. According to systems principles, a system is *different* from the sum of its parts. At each successively higher

[4] Robert Jervis, Complexity and the Analysis of Political and Social Life, 112 Political Science Quarterly 572.
[5] John D. Sterman, Learning in and about complex systems, 308. *See* Malcolm Gladwell's Outliers for an explication on how success is as much a function of the opportunities as innate capability.

level of complexity, there are emergent properties which cannot be found in the parts of a system. For example, the elements hydrogen and oxygen chemically interact to produce water molecules. One could study the elemental gases hydrogen and oxygen individually and never discover the characteristic of wetness. Wetness is an emergent characteristic of the mutual interaction of hydrogen and oxygen.[6] Similarly, the melodic cry of a songbird is not to be discovered within the cells or body tissue of that bird.

The principle of emergent behavior draws our attention to the differences between the behavior of a system and the behavior of its parts. Sometimes, emergent properties are a product of synergies. Aristotle memorably defended representative assemblies on the grounds that the people, no matter how debased or flawed as individuals, may be collectively superior to a select few of the very best men. According to Aristotle, the people, when assembled, have a combination of qualities that they lack as individuals.[7] The assembly is more than the sum of its parts. However, the behavior of a system can be more than *or less* than the sum of its parts. In *The Federalist*, No. 55, James Madison complained that "[i]n all very numerous assemblies, of whatever characters composed, passion never fails to wrest the scepter from reason. Had every Athenian been a Socrates, every Athenian assembly would have been a mob."[8] Herd behavior describes the phenomenon of individuals with varying propensities and predispositions acting differently in a crowd.

Emergent system properties are as much a product of the interaction and organization of a system's parts as the parts themselves. We must look at how agents are positioned and interacting within a system to explain system behavior. For example, individually, sticks snap easily. When bundled together, each stick is more difficult to break. It is the organization and relationships between a system's parts – its *structure* – as much as the components themselves that shapes system outcomes and system behavior. The structure of a system creates synergies, economies of scale, and totally different behavior. This is why, from a systems perspective, a system is non-summative. All systems have a structure, and those structures *matter*. Systems theory represents a logic (not just a perspective) that reasons from relationships between parts rather than the parts themselves. In fact, it is the connections and interactions between the parts of a system that make a system intelligible as such. If the parts were independent of each other, they would not constitute a system.

As we have seen, the structure of a system is important, and the internal characteristics of the parts of a system may matter less than their placement and influence within the system. But when we attribute differences in system behavior to differences in personality, we lose sight of the role of system structure in shaping (constraining or enhancing) that individual's choices, and thereby producing the system's behavior.[9] In a system, the patterns of behavior that emerge are often very different from the intentions or the behavior of the individual parts. In complex systems, outcomes do not follow from intentions. An individual's intentions may be thwarted through the interaction of that individual's decisions with the behavior of others. This is the nature of competition.

[6] Bellinger, Gene. "Systems: A Journey Along the Way." http://www.systems-thinking.org/systems/systems.htm
[7] Aristotle, Politics III, Ch. 11.
[8] *Id.*
[9] *Id*. at 308

Consider the basic case of two firms competing in a market. The first firm develops and sells a new product with the hopes of making a large profit. The profitability of the venture entices another firm to sell a similar product in the same market. The additional production supply prompts the initial firm to lower prices to reduce inventories. This forces the other firm to follow suit. As a result, neither firm makes as much money as it intended. The behavior of the system does not depend on what each part is doing or its intentions, but on how each part is interacting with the rest. Thus, one cannot infer a system's results from the desires, intentions, expectations or behavior of its individual parts. Reductionism, the methodology of analytical reasoning, seeks to understand the behavior of a system by doing just that.[10]

Racial differentials in the United States are as much a product of system structure as they are of individual behavior. Although bigoted, interpersonal discrimination persists, racial advantages and disadvantages are primarily a product of opportunity structures within society.[11] Interlocking systems of disadvantage disproportionately shape and constrain the choices and life chances of people of color. A systems perspective is a model which assumes a general interdependence between many factors that compose the opportunity structure. And indeed, five decades of social-science research have documented the relationships between racially and economically isolated neighborhoods and employment, health, crime and violence, educational outcomes, and a range of other factors. A systems perspective draws these insights together in support of a single model.

We must never lose sight of the role of a system as a whole in shaping outcomes, and must always account for systemic effects as well as the effects of the parts of a system. System outcomes are reflective not only of the constituent parts that compose the system, but the myriad networks of interactions that define the systems structure, and just as importantly, the ways in which those interactions – whether by synergy or otherwise – constrain and influence the path of other parts and the shape of their interactions within the system. System outcomes that fail to correspond with the behavior of component parts are a signal to examine the interactions between parts and the organization of those relationships within a system.

II. Multiple and Mutual Causality

A systems thinking approach yields new insights and brings into view a very different understanding of causality. The traditional view of causality is linear, with an emphasis on identifying and isolating proximate causes for any given effect. A systems approach recognizes that each effect has multiple causes, and each cause has multiple effects. Outcomes are a product of mutual, multiple, and reciprocal interactions within the system. The emphasis on searching for a single cause to particular racial harms as a way of assigning responsibility and blame causes us to overlook the ways in which systematic racial advantages and disadvantages are produced through the interaction of many causes.

Under a traditional, linear view of causation, causality flows in one direction, from proximate cause to effect and stimulus to response, like falling dominoes or the Pavlovian response of dogs that salivate upon hearing a bell ring.

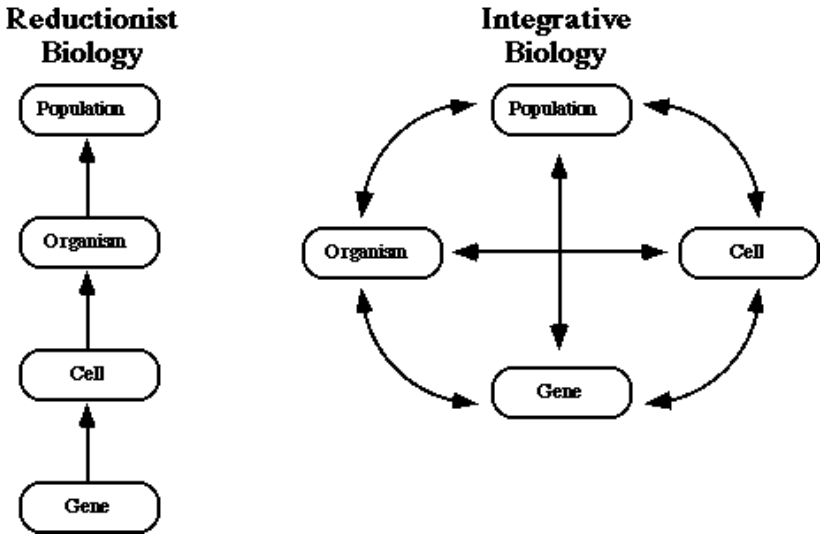
[10] *Id.*
[11] Galster, powell, reece, etc.

A → B → C → D → E
(A causes B causes C causes…)

Each effect is ascribed a single proximate cause. The law contributes to this paradigm with its preoccupation with causation and identifying "proximate" causes in assigning tort liability or criminal responsibility. The linear model of causation is so deeply ingrained that it manifests itself in a series of implicit assumptions about how the world works. Conceptual models such as a food chain or economic development are linear, moving from point A to B to C and so on. Even complexity is commonly understood as reducible to a series of linear relationships, and in time ideas such as a food chain gave way to the food web. Complexity was understood as merely the sum of, and reducible to, a set of linear relationships.

Systems thinking represents a paradigm shift responsive to the pervasiveness of linear thinking based on a recognition of the interdependence of phenomena. Thus, the model of the food web, even with the additional insights it provided, was incomplete, and gave way to a systems model of an ecosystem. In systems theory, 'cause' and 'effect' are not so easily isolated. An input does not 'cause,' in a proximate or ultimate sense, an outcome in a system; it only modifies existing processes which produce those outcomes. Or, as Gunnar Myrdal wrote over six decades ago, "[i]n an interdependent system of dynamic causation there is no 'primary cause' but everything is cause *to* everything else."[12] Consider the contrast between linear causal models in biology and a dynamic, non-linear model of causation in the Figure below.

MODELS OF CAUSALITY **Fig. 1.1**



http://www.lclark.edu/~autumn/Dissertation/Fig.1.1.html

In the reductionist model, a linear cause and effect chain is built from Gene to Cell to Organism to Population. In a dynamic, systems model, each of these inputs interacts and causes each other. It is the *interaction* among system agents that produces outcomes. In that sense,

[12] An American Dileimma 78.

outcomes are a product of many causes working together rather than a single or proximate cause. Consider again the two-firm example in the previous section. The price of the good produced by the firms was ultimately determined by the interaction of the decisions of the two competing firms, among other factors, and not by either firm alone setting the market price.[13] These causes were mutually interactive, just as the position of the Earth's orbit is a product of the interaction of its gravitational pull interacting with the sun's gravitational pull. In fact, pricing decisions of the two firms were in turn influenced in a dynamic process by the purchasing decisions of consumers.

In contrast to the linear paradigm, causation is multiple, multi-directional, cumulative, mutual, and reciprocal in general systems theory. Multiple causation is the recognition that there are no ultimate causes for any given system outcome. Rather, outcomes are the product of many causes interacting over time (see Fig. 1.1). Mutual causation is the recognition that outcomes are often the result of causes acting in concert to produce an effect. Reciprocal causation is a type of mutual causation that models how causes directly interact with each other. For example, in the United States, housing stock and school quality are reciprocally interrelated (see Figure 2). The quality of a local school determines the value of the homes in the area by influencing the demand for housing stock. In turn, the value of the housing stock influences the quality of local schools. Nearly half of all property tax revenue is used to fund elementary and secondary education.

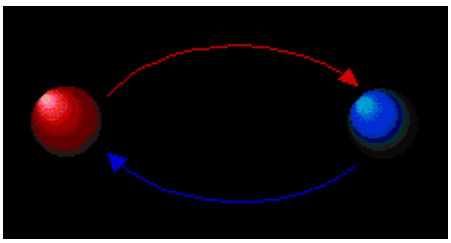


Figure 2: Reciprocal Causation

Research shows that people tend to assume that each effect has a single cause, and often stop searching for additional explanations when a sufficient cause is found.[14] From a systems perspective, this is problematic. Causal chains in systems theory tend to map effects which have many causes, and each cause has many effects.

In the search for understanding the production of racial disadvantage, we stumble over the question of responsibility and blame. Much of our anti-discrimination jurisprudence is simply linear causality tort models. Rather than developing a deeper understanding of how many causes produce system-wide racial advantages and disadvantages, we begin each claim of racial discrimination with a search for proximate causes. In this way, litigation strategies trap us into trying to identify intentional causation, isolated causation or even effects (which also implicates a linear causation theory even as it looks at the output rather than the input).[15] Each of these overlooks the way in which inputs interact with other inputs to produce a particular outcome.

[13] This relationship is variously described in systems theory literature as a "co-emergent event," or "dependent co-arising," (Hanson, Macy)
[14] Sterman, 308
[15] Thanks to Lani Guinier for this particular insight.

In *San Antonio v. Rodriguez*, the Supreme Court held that an educational funding system based on local property taxes which resulted in large disparities in per-pupil spending between predominantly White districts and predominantly Black and Latino districts did not violate the Constitution because plaintiffs could not show the disparities were the result of intentional racial discrimination.[16] A systems approach would account for the causal connections between past housing discrimination, housing value, and school segregation, and poor educational outcomes. The search for intentionality overlooked the way in which a school funding formula built upon patterns of racial and economic segregation and thereby created racialized disparities as a patterned outcome.[17]

If one were to examine the historical facts of housing segregation and redlining, the de-regulation of the credit industry in the 1980s, and the securitization and pooling of mortgage loans separately, one might never anticipate the global economic crisis resulting from the spread of subprime loans. It was the interaction of these events, cumulatively and over time, that produced the resulting foreclosure and credit crisis.

[16] See San Antonio School District v. Rodriguez, 411 US 1, 14 (1973) (*citing* TEXAS RESEARCH LEAGUE, PUBLIC SCHOOL FINANCE PROBLEMS IN TEXAS 9, 13 (Interim Report 1972) (stating that Alamo Heights, because of its relative wealth, paid approximately $100 per pupil; Edgewood, on the other hand, paid only $8.46 per pupil)).

[17] Similarly, the disproportionate impact suffered by black and brown Americans in New Orleans from Hurricane Katrina was a result of many factors. The history of urban divestment and economic and racial segregation forced poor and minority residents into the most neglected and vulnerable coastal areas. The result was that these vulnerable communities were disproportionately affected by the flooding caused by the breech of the levy walls.

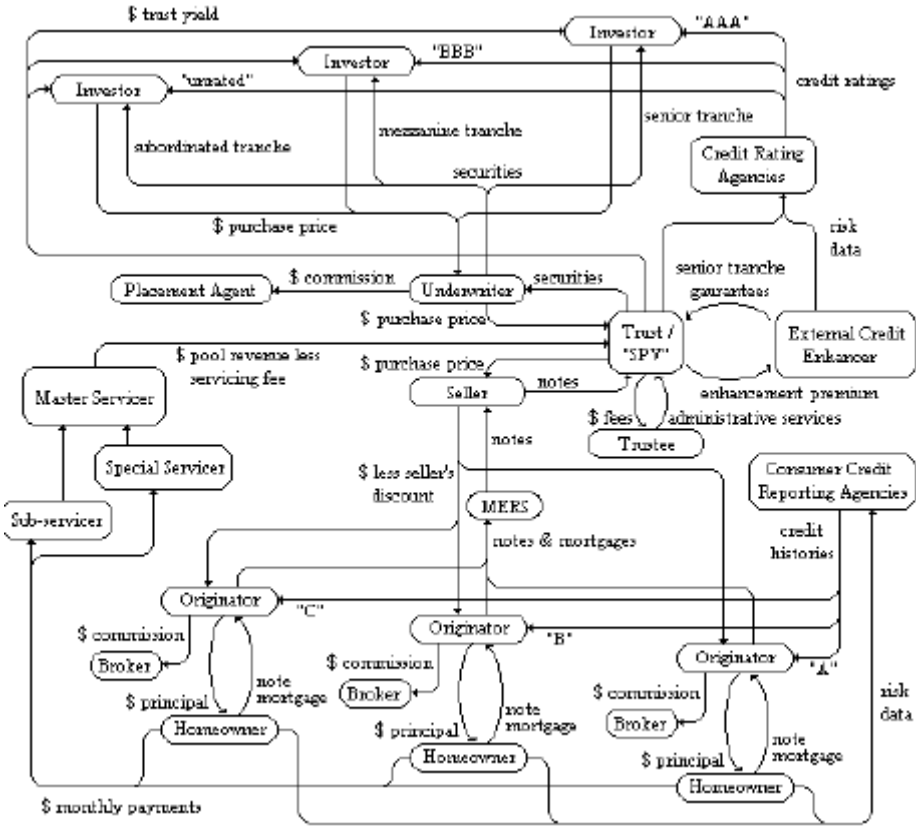


Figure 3: Subprime Mortgage Securitization Structure[18]

III. Cumulative Causation

The traditional model of causation is not only linear, it is also reductionist. By trying to identify a particular cause for a given outcome, the search narrows to a particular moment in time or place where the cause we are examining is to be found. For example, as part of a Title VII disparate treatment discrimination claim, a plaintiff must show that the defendant discriminated, that the plaintiff was harmed, and that the discrimination caused the particular harm, both as a matter of actual causation, but also proximate causation. This leads to a narrow examination of the particular discriminatory action at a particular point in time. A systems perspective helps us see how this analysis may be quite limited and misleading.

The typical cues to causality, such as proximity of cause to effect in time and space, lead to great difficulty in complex systems. In systems, causation is multiple, effects are multiple and nonlinear, there are many interconnections, and delayed and distant consequences.[19] When a penthouse tenant prepares a bath, he adjusts water temperature with the hot and cold spigots. The temperature of the water initially emptying into a bathtub does not reflect the act of turning the hot water spigot until sufficient time has passed for the hot water to travel up from the basement water heater. This sort of delayed effect is common in systems, as inputs work their way through the system pathways.

[18] Christopher L. Peterson, An Introduction to the Role of Securitization in Residential Mortgage Finance
[19] Sterman 308

The insight that inputs follow pathways within a system leads to another insight regarding how causes might accumulate within the system. Cumulative causation[20] is a form of multiple causation in which a cause within one domain may influence other causes within that domain over time, or in other domains, so that the initial causes produce much larger systemic effects. The attempt to isolate causation to a single domain at a single point in time, a hallmark of linear analysis, overlooks this insight.

Although racial advantages and disadvantages may be products of various interactions in different domains, from a systems view, they are not summative. In other words, the total level of racial disadvantage is not simply the sum of discrete instances of discrimination suffered. It is often much larger. A systems perspective shows us that discrimination or disadvantage experienced in one domain tends to accumulate across domains and over time because of the relationships and interactions that exist between those domains and events within those domains.

Consider the interrelationship between AP classes and university admissions. Higher education admissions policies make college access partially reliant on a student's access to AP classes. Wealthy public schools generally offer more AP classes than lower income schools, which may not offer AP classes at all. Historical segregation and housing policy result in low-income schools having higher proportions of minority youths. Lower admission rates in higher education for minority students are shaped by these multiple, interrelated factors which spill across domains within the system.

Racial impacts are often the product of cumulative interrelationships across *time* and across *societal settings*. The traditional discrimination model focuses on the impact of discrimination on an outcome at a point in time and within a particular setting. A labor economist's analysis of discrimination in a particular labor market, controlling for background characteristics and educational preparation of labor market participants, ignores the previous discrimination in education, housing, and health markets. Consequently, it may ignore the means by which a labor market became stratified in the first place. Discrimination may have cross-generational effects which accumulate over time and spill across domains. In a system, each component and relationship is strongly influenced by interconnections in other places and points in time.[21]

Consider the legal claim of reverse redlining.[22] Redlining was the formal segregation practice where a mortgage bank would only approve loans in racially homogenous neighborhoods. The practice of redlining created segregated neighborhoods and its effects are still apparent today. The resulting relationship between race and neighborhood allowed for the practice of reverse redlining, where a mortgage company targets these segregated neighborhoods for deceptive, unfair, and discriminatory lending, disproportionately placing the burden of subprime loans and foreclosures on African American homeowners. If not for the original redlining practice, reverse redlining would not have been feasible.

[20] This term was developed by Gunnar Myrdal.
[21] (Jervis 18).
[22] Insert cite to Baltimore suit

IV. Systems Resist Change (Negative Feedback)

The model of change from an analytical and reductionist perspective is to simply change one input for another. If A causes B, and B is harmful, then if we simply change A, then we can eliminate B. A systems approach not only illustrates how this simple model of causation is flawed, but also helps us to see why attempts to create systemic change often fail.

Complex systems, whether biological, institutional, social or otherwise, have feedback loops. In feedback, the output of the system, or part of the system, is a new input into the system. In this way, feedback loops can help the system adapt to changing conditions and thwart change, as frustrated Mayors, superintendents, and CEOs can attest. This does not mean that one cannot fundamentally transform a system, but instead describes the properties of *autopoiesis* and homeostasis; the self-organizing and correcting nature of complex systems. The specific mechanism by which systems maintain this state and adapt to changing inputs is known as *negative feedback.*

There are many examples of this mechanism in the biological and physical sciences. For example, a drop in outside temperature triggers a negative feedback loop in the human body. The nervous system adjusts to cold by shivering. Shivering is a muscle reflex that shakes vital organs to generate warmth. Similarly, the presence of a virus alerts the immune system and triggers antibodies to attack the invader to return the system to health. To take another example, DDT was a chemical used to quell insect populations, but did not have the desired effect. DDT remained in the bodies of bugs, which were eaten by birds. DDT in the bugs reacted with the biological system of birds by making female birds lay eggs with soft shells that could not hold embryos. The species of bug eating birds decreased dramatically where DDT was used.

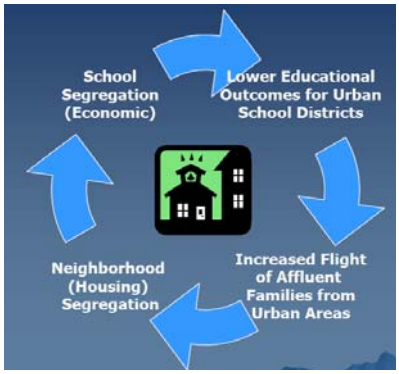
Negative feedback processes are also visible in social systems. In 1996, California enacted a bill to reduce elementary school class size. The purpose of the bill was to close the achievement gaps between middle class and low-income school districts. Because class sizes were reduced, more teachers were needed at all schools and numerous teaching positions opened up throughout the state. As a result, qualified teachers in urban areas fled to higher paying and higher-performing schools in the suburbs. Lower income school districts were forced to hire teachers with less experience and lower credentials, threatening to maintain, if not widen, the achievement gap.[23]

Consider as well the history of school desegregation efforts. To remediate *de jure* school segregation, courts ordered racial integration. However, segregation persisted when white parents moved beyond district boundaries or transferred their children to expensive private 'white only' schools. Today, many school districts are as segregated as they were when *Brown v. Board of Education* was decided.

[23] Stecher, B. M., McCaffrey, D.F. & Bugliari, D. (2003, November 10). The relationship between exposure to class size reduction and student achievement in California. *Education Policy Analysis Archives, 11*(40). Retrieved July 9, 2008 from http://epaa.asu.edu/epaa/v11n40/.

V. Leverage Points (Positive Feedback)

When a system fails to adapt to new inputs or its feedback mechanisms can be impeded, a system can be transformed. This transformation can be accomplished through a *positive feedback* loop. Positive feedback is a catalytic intervention or a snowball effect. Whereas a negative feedback loop is self-correcting, a positive feedback loop is self-reinforcing; the more it works, the more it will continue to induce change. An example is the working of a savings account. The more money one has in the account, the more interest one will earn, and the more interest one earns will increase the amount of money (and interest) in the account. Housing segregation is also a positive feedback loop. Housing segregation fuels school segregation that fuels lower educational outcomes for urban districts, which leads to flight of affluent families from urban areas, which in turn perpetuates housing segregation. The more housing segregation exists, the more it will continue to exist. This is the vicious circle.[24]



Because of the possibility of triggering a positive feedback loop, small events can give rise to large outcomes. Smaller problems in one domain can cause larger problems in another domain because of their interrelationship. For example, the assassination of Archduke Franz Ferdinand in 1914 and subsequent retaliation by Austria-Hungary against Serbia set off a series of alliances that quickly became a World War.

Systems theorists believe that there are places to intervene in a system that can change system outcomes. Drastic changes to a system are the result of introducing input at leverage points. Leverage points are the places within a complex system where a small shift can produce a large change throughout the system.

The idea of leverage points is familiar to Western thought; where we see poverty, need, and lack of urban growth, for example, we build public housing projects. We try to alter the system by introducing a solution (houses) to the problem (lack of housing) in the area where we believe the problem is the most dire (the inner city). The systems thinker, however, recognizes that leverage points are not so intuitive. Jay Forrester, the lead thinker in systems dynamics, discovered that public housing concentrated in a city center effectively increases unemployment and welfare costs rather than aiding the poor and homeless.[25] This is because public housing, without job creation efforts, disrupts the population to available employment ratio. Poor people receive housing in an area that is not able to provide jobs proportional to their numbers. Systems theory

[24] This phenomenon was described by Gunnar Myrdal in "AN AMERICAN DILEMMA" 75 (1944).
[25] Donella H. Meadows, Leverage Points: Places to Intervene in a System, *Sustainability Institute Report* 1999.

reminds us that the key to finding leverage points is to not look at the problem in isolation, but to look at the entire system; the parameters, positive and negative feedback loops and what drives them, time delays, rules of the system, goals of the system, structure of the system, and the information delays. This holistic view of the intervention process takes us out of the linear causation paradigm and allows us to incorporate the history, dynamics, and structure of a given problem in order to craft more effective and lasting solutions.

Positive feedback loops are important leverage points. Finding and weakening or enforcing positive feedback loops can change or create relationships that change or create system behaviors. This stands in opposition to using negative loops to regulate positive ones.

The housing crisis in the United States is a positive feedback loop. Mortgage lenders packaged and sold mortgage loans to investors on Wall Street who in turn demanded more loans, leading to lenders actively seeking borrowers, regardless of risk. The negative feedback loops in place – in the form of weakened Truth in Lending laws – were not strong enough to overcome the positive loop. The positive loop was only stopped when banks collapsed as mortgage borrowers became unable to pay for their subprime loans, quelling the stock market frenzy. The destruction of this positive loop – rather than the regulation of the positive loop's gains – created the potential for the dismantling of the mortgage lending system and an opportunity to develop a new system that is more fair and more stable. Similarly, we can intervene in the wealth-breeds-wealth positive feedback loop. Progressive taxation, inheritance tax, and high quality public education not tied to property taxes are all measures that can slow the positive feedback loop that creates more success for the already successful and create a more egalitarian society.
It is important when attempting to transform a system to keep in mind what is called the Precautionary Principle. The 1998 Wingspread Statement on the Precautionary Principle summarizes the principle this way: "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically." Because effects are multiple, unpredictable, interconnected, and delayed in time, it is important to take care when acting to reduce the harmful effects of one's actions. Just as a problem in one domain may create problems in another domain, solving a problem in one domain may alleviate problems in another domain. This is the promise of a properly aimed transformative intervention. However, a successful intervention will require attentiveness to system feedback loops and the means by which the system will resist change.

Conclusion

The principles of systems theory just enumerated are essential to understanding the production of racial inequality in contemporary American society. Although bigoted, interpersonal discrimination persists, racial disadvantage is primarily a product of opportunity structures within society. A systems perspective helps us understand how racial disadvantages manifest, accumulate, and resist efforts to address them by allowing us to see the world in terms of wholes, rather than in single event 'snapshots' and how parts of a system work together to produce system outcomes. They also help us see that the good intentions of policy makers may be thwarted.

Systems thinking does not mean that we cannot act, but that we should perceive the way we act differently. It requires that we are attentive to relationships within the system and to the response from the system to our interventions, including those responses which are immediate and those which will unfold over time. There are a number of immediate and important implications for using systems thinking over a linear, reductionist approach. Consider our approach to education and schools. We have approached schools largely as a separate institution without clearly looking at the relationship of school policy and housing policy. We have national educational policies such as No Child Left Behind that, among other things, try to rescue children from failing schools, which are overwhelming racially and economically isolated. However, the largest federal affordable housing programs that build housing for these families locate much of this housing in racially and economically distressed and isolated communities. A systems approach would account for the relationship between housing, schools and fiscal policies. If an intervention was made, it would also consider how the system adapts and undermines these interventions to maintain the status quo.[26] The courts and policymakers are ambivalent about looking at interrelationships as the use of Newtonian logic and the focus on intentionality attests.

Global leaders recognize that the response to the recent financial crisis cannot be met by one nation alone. The crisis is global, with systemic causes and effects. One nation's efforts would prove insufficient to the task of addressing the crisis.

Systems thinking can greatly inform our understanding of both structures as well as some recent developments in cognitive science. But systems are not simply abstract notions. We not only live within them, we are part of them. As part of the system, it turns out that we cannot change systems without changing ourselves as well.

[26]*See* Brief of the Caucus For Structural Equity as *Amicus Curiae* Supporting Respondents, *Parents Involved in Community Schools v. Seattle School Dist. No. 1*

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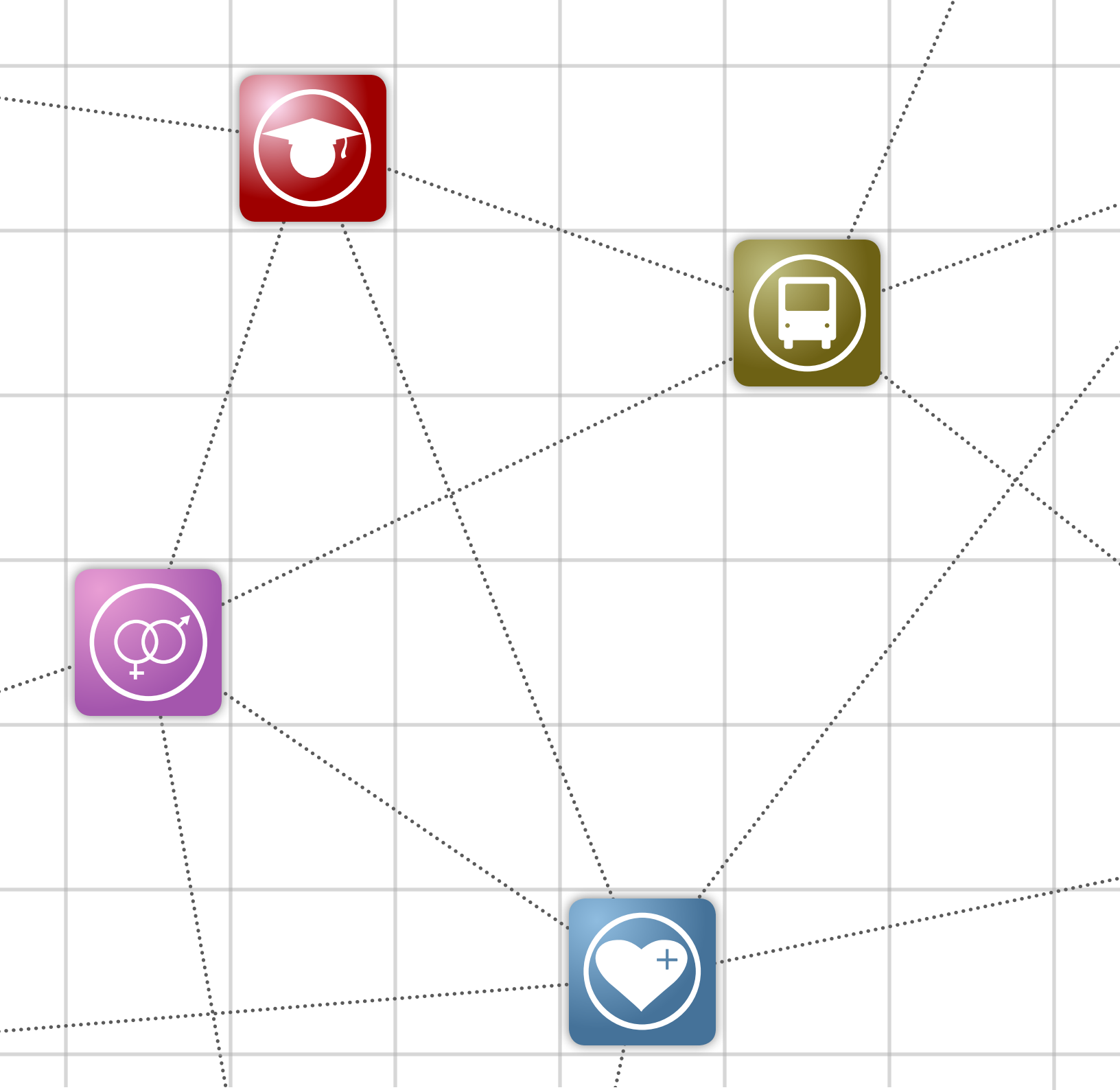

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