Crisis in Complex Social Systems: A Social Theory View Illustrated With the Chilean Case

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The article argues that crises are a distinctive feature of complex social systems. A quest for connectivity of communication leads to increase systems' own robustness by constantly producing further connections. When some of these connections have been successful in recent operations, the system tends to reproduce the emergent pattern, thereby engaging in a non-reflexive, repetitive escalation of more of the same communication. This compulsive growth of systemic communication in crisis processes, or logic of excess, resembles the dynamic of self-organized criticality. Accordingly, we first construct the conceptual foundations of our approach. Second, we present three core assumptions related to the generative mechanism of social crises, their temporal transitions (incubation, contagion, restructuring), and the suitable modeling techniques to represent them. Third, we illustrate the conceptual approach with a percolation model of the crisis in Chilean education system. © 2016 Wiley Periodicals, Inc. Complexity 21: 13–23, 2016

Key Words: crisis; social complexity; social systems; communication; contagion

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1. INTRODUCTION

The crisis is a structural signature of modernity [1]. Since the ideology of perpetual progress in the nineteenth century and the corresponding belief in a steady economic growth in the twentieth century have been put into question by increasing inequalities, segregation, and injustice at both national and global level, the logic and social foundations of crises, catastrophes, and disasters gain attention from the perspective of social sciences interested in complex phenomena.

In this article, we argue that social crises are a distinctive feature of complex social systems. We define social systems as networks of communication among units (individuals, groups, organizations, major functional systems such as economy, law, politics) characterized by an immanent quest for connectivity [2–5]. In other words, social relations bring about further social relations, either conflictive or cooperative [6]. Crises originate as in these social networks emergent repetitive patterns of communication arise. The generative mechanism of social crises is

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thus characterized by an overproduction of previously successful activities that engage the system in a compulsive repetition of *more of the same*, thereby attaching social communication to a positive feedback dynamics that leads the system toward a critical point after which it cannot longer sustain its own structure. The crisis is the outcome of this immanent tendency of scaling communication.

Our theoretical model contend that crises in complex social systems are not a singular event, but result from a process that unfolds in three stages: *incubation*, in which the system incrementally develops a recursive dynamics of non-reflexive repetitions that weakens both its adaptive capabilities and connections; *contagion*, whereby the effects of that dynamics expands to different systems or clusters in the network; and *restructuring*, namely, a reorganization of both the system's own conditions of functioning and its interrelationships with the environment. Next we argue that percolation and sand pile models are suitable techniques for both modeling this process and analytically distinguishing between three phases of social crises. We illustrate our propositions with a view on the crisis of the educational system in Chile—a country in which over the last forty neoliberal reforms led to an incremental monetization of public education.

The article proceeds as follows. First, we begin with a literature review on crisis in social sciences (particularly in social systems theory) and elaborate on the consequences of the immanent quest for connectivity of social communication regarding social crises. Second, we propose three assumptions for outlining a theory of crisis in complex social systems. The assumptions consider a generative mechanism, phases of crisis, and suitable modeling techniques. Third, we illustrate these assumptions with a case from contemporary Chilean society. And fourth, we summarize our findings and suggest some lines for further research.

2. CRISIS AND COMPLEXITY IN MODERN SOCIETY

Following Koselleck [1], the concept of crisis had for the Greeks well-delineated meanings in law (a decision in the sense of reaching both a verdict and a crucial point), theology (a cosmic event of pure justice that shall affect everyone and from which Salvation for the just is to be attained), and medicine (the indefinite course of an illness "in which a decision is due but has not yet been rendered" [1, p 361]). These different meanings remain rather untouched until the 17th century, as they begin to be metaphorically used in politics [7], economics [8,9], and history [10–12]. The concept designates the end of an era (political revolutions, decline of monarchy, weakening of religious ontological, and epistemological authority) and the beginnings of modernity (new forms of political organization, capitalism, scientific knowledge, disenchantment of the world, differentiation, interconnectedness). It reflects, therefore, a major structural change from stratification to modern society—a *catastrophe* in a technical sense [13].

Modern society, in turn, produces its own conditions for incubating social crises. Contemporary society is characterized by the differentiation and interrelation of multiple organizations and major functional systems such as economy, politics, law, science, education [2,3]. Every systemic operation presupposes connectivity of self-referential communication to sustain their own functioning (institutions, procedures, expectations, symbols) and accomplish their social function (required social transfers to other systems). Thus, social systems "are endogenously restless and constantly reproductive" [14, p 13]. Their very existence depends on their ability to *connect* their present operations with the next ones and create a complexly interrelated web of connections that we call social networks. In this complex *milieu* "the connectivity of recursive operations is the new imperative" [4, p 9]. Connectivity presupposes, therefore, an immanent drive for expanding the communicative logic of each system (expanding the logic of money in economy, of power in politics, of legal norms in law) that has significant consequences for the production of systemic crises. We organize these consequences in four points.

First, connectivity brings about regular and synergic patterns of functioning, but it also manages to reintroduce previously successful selections that engage the system in a non-reflexive reiteration of the past or positive feedback, thereby producing what we call *logic of excess*. As Battiston et al. argue [15, p 819] regarding financial systems, the generic feature of positive feedback leads "to persistent deviations of prices from equilibrium and emergence of speculation-driven bubbles and crashes, strongly amplified by coordination on trend-following and herding behavior." Concerning the financial crisis 2008, Bouchaud [16, p 597] uses the concept of *excess correlations*, namely, when "the sensitivity of the market to external information is anomalously amplified by the impact of traders using that information." In a similar way, Haldane and May [17, p 353] attribute the financial crisis to the "*excessive homogeneity* within a financial system—all the banks doing the same thing," which reduces the risk for the single bank, but "maximize the probability of entire system collapsing."

Second, the logic of excess arising from the quest for connectivity of social communication behaves similarly in contexts other than the economy. Parsons [18–20] understands this in terms of systemic inflation and deflation: "Inflationary–deflationary trends tend to spiral; there is sometimes overcompensation in the deflationary direction

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following an inflationary period" [21, p 311]. Inflation (logic of excess) in politics means a situation of overcommitment that cannot be met by institutional capabilities; deflation, in turn, implies a coercive and authoritarian use of power instruments that suppresses political pluralism. In community contexts, the inflation of influence leads individuals to trust in opinions that are not supported by solid information, and deflation, conversely, undermines trust in social institutions and broader circles of persons—it fosters individualism and ghetto situations. Both inflation and deflation of communicative logics point out to two moments in crisis processes that we call *contagion* and *restructuring*, thereby revealing the cyclical dynamics of crises. In inflationary phases, the logic of excess expands a selected communication rapidly as in the dynamics of riots [22,23], while in deflationary phases social complexity looks for reorganization after avalanches, for example by implementing martial law to suppress riots, introducing strong regulations in economic crises or reconfiguring the political scenario through constitutional revolutions in institutional crises [24].

Third, as the system engages in the logic of excess, transmission of excesses and overflows take place. Considering the complexity of interconnections between modern social systems and their network dynamics, there arise avalanche effects both in one single system (as in the prototypical case of sand pile dynamics) but also in other fields deriving from inflation in other systems. As an example of avalanches in one single system, Besomi [25, p 94] notes that economic crises trigger "the transmission of excesses from one person to another, from one business to another, from one country to another, and from one branch to another." On the other hand, overflows or spillover effects from one system to another emerge, for instance, as decreasing trust in legislation affects economic expectations, or as a deflated coercive politics reduces the operational leeway of media, education, and public liberties. As the system engages in a non-reflexive pattern of reiteration, namely, in the positive feedback of the logic of excess, the limits become porous and "framing [holding the borders] is either impossible to achieve or is deliberately transgressed by the actors: this produces overflows which cause the barriers to become permeable" [26, p 251]. The crisis escalates, therefore, to different network dimensions and to different clusters in the network.

And fourth, considering the aforementioned points, we argue that social crises follow the rules of self-organized criticality. Particularly when the observation scale focuses on one specific system, crises behave as in sand pile dynamics (adding grains to a sand pile leads to critical angle avalanches) [27]. They slowly *incubate* in a subcritical state, subsequently approach near to the critical level (*contagion*, inflation) in which the structure can still hold minor avalanches, and *restructure* the configuration of the network once criticality thresholds are exceeded [28]. Yet a peculiarity of some major social crises (revolutions, wars, generalized legitimation crises, translocal, or global catastrophes) consists in the circulation of excesses and overflows through multiple systems [29]. In those cases, we also consider percolation dynamics (dissemination of traits in a network with diversity of clusters) as a useful representation [30–33]—particularly for explosive transitions with spillover effects covering the whole network [34,35].

3. A MODEL OF CRISIS IN COMPLEX SOCIAL SYSTEMS

Social complexity is, therefore, the medium in which crises emerge and evolve. A theory of crisis in complex social systems must be able to recognize the generative mechanism that brings about the crisis process, the phase transitions, and the suitable modeling techniques for analyzing its dynamics. Accordingly, we organize our approach under three main assumptions: (1) we define the generative mechanism of crises as a process in which regular communication of social systems morphs into a non-reflexive reiteration of previously successful selections, thereby producing spillover effects that, in the long run, affect the dynamics of the entire network; (2) we identify three main phases of crisis processes: incubation, contagion, and restructuring; and (3) we consider modeling techniques that express the incremental dynamics of social crises in the incubation phase, a rapid dissemination in the contagion phase, and a reorganization of social ties in the phase of restructuring.

Assumption 1: Compulsive growth of systemic communication is the generative mechanism of social crises. We consider a dynamics of inflation of systemic communication. Given the quest for connectivity of social communication, each system manages to increase its own robustness by producing further connections. When some of these connections have been successful in recent operations, the system tends to reproduce the pattern, thereby engaging in a non-reflexive, repetitive escalation of more of the same communication. This endogenous and self-produced dynamics of social systems (logic of excess) is the generative mechanism of crises. It can be called a *compulsive growth* of systemic communication [4]. Because of this mechanism, the inflationary system expands its influence upon other fields (spillover effects) to reproduce its own excess, thereby leading to interferences in the autonomy of other social systems or clusters in the network. This results in an overabundance of the particular communication of the inflationary system in society as a whole. Well-known examples of this situation are monetization in

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neoliberal societies, politicization in both totalitarian and authoritarian systems, religious dogmatization, juridification and bureaucratization in the welfare state. In those cases, "communications would concatenate so that they would become caught up in compulsive engagement in an activity" [4, p 4]—being this activity the core operation that reproduces the dynamics of excess.

Assumption 2: Incubation, contagion, and restructuring are the phases of social crises. The *incubation phase* is characterized by a subcritical systemic state in which the system responds to internal or external requirements. As communication is self-referentially constructed, social systems tend to reproduce their own success, thereby loosing reflexive capacities of adaptation (coupling conditions) and triggering spillover effects that interfere in the operation of other systems. There is a difference, for example, between public financing of politics (regular coupling of economy and politics) and bribes (compulsive growth of money affecting politics and overloading economy), between practicing faith (subcritical functioning of religion) and fundamentalism (compulsive growth of religion affecting fundamental rights and overloading religion), between state-led policies (subcritical functioning of democracy) and totalitarianism or bureaucratization (compulsive growth of politics affecting the whole and overloading politics). These events of interference are cumulative and incubate problems of systemic autonomy that disrupt the regular operations in the interfered system, overload the interfering system with external complexity, and produce systemic miscoordinations affecting the resolution of social problems [36].

Interconnectedness of social networks and institutional homogenization (isomorphism [37]), namely the very foundations of modern global order, are crucial conditions for these spillover effects in the *contagion phase* [38]. They are the infrastructure of high-speed contagion. The crisis becomes thus recognizable for different group of persons. They perceive how interferences produce institutional outcomes that affect their personal or familial life-projects (unemployment, low salaries, deficient education quality, defective health services) and communicate their dissatisfaction publicly (protest movements, limited confidence and trust, electoral volatility, disrupted social integration). In the contagion phase everybody becomes susceptible [39]. This means that the communication of crisis speeds up and spreads to social groups not sensibly affected by defective institutional outcomes but certainly exposed to the communication of crisis of those who experience the crisis as a real danger.

Therefore, contagion of crisis is something rather different to the *real* crisis itself: while the crisis relies on a factual dimension, contagion unfolds in a semantic dimension. However, the social exposure to the communication of crisis makes everyone aware of her or his own susceptibility: the crisis morphs into a generalized horizon against which existing problems and the uncertainty of the future are reflected. The communication of crisis becomes thus as effective as the factual crisis. Terrorist attacks in a certain region lead governments everywhere to take measures that introduce their citizens into the experience of a real terrorist danger [40], political crises scare off foreign investment so the crisis infects the national economy [41], foreclosures in particular domestic districts produce a world-wide financial run that turns a local crisis into a full-scale riot [42]. Near to criticality, a single bifurcation in one node may infect the social space rapidly, merging therefore both the operative and semantic dimension of communication into a singularity: we become communicatively involved with the effects of a crisis before the operation of crisis gets to us, and as a consequence of the singularity between both the semantic and operational dimensions, we turn into the practical, conscious yet non-intended, namely paradoxical propagators of the crisis in our own social domain.

Restructuring involves two possibilities, either a return to subcriticality (e.g., reestablishing the rule of law after a riot—elastic restructuring) or a major reorganization of the network (e.g., constitutional revolutions—plastic restructuring). In both cases, there arise transitory or extended deflationary periods. In deflationary periods, the compulsively grown communication originating the crisis loses its connective power (economic depressions, political illegitimacy, legal distrust, cultural blackouts). Social systems either morph into another version of themselves after the crisis (as in reformation processes) or, because of a generalized lack of trust, fully restructure their internal relations in the aftermath of a catastrophe (as in revolutionary processes).

Either way, complex social systems restructure themselves in a permanent dispute between different and even contradictory alternatives. From the perspective of the individuals, diverging agential projects meet in social practices the constraints and enablements of social structures and alter them in a morphogenetic process [43]. And precisely that morphogenetic restructuring (either smooth or catastrophic) creates the conditions for further crises because individuals' critical attitudes reintroduce both the potentiality and actuality of crises, on the one hand [44], or because the translocal homogeneity and interconnectedness of the new systemic situation remains the basis for creation and destruction in modern society, on the other.

Assumption 3: Models of scaling communication processes can represent the dynamics of social crises. Suitable modeling techniques for crises analysis

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in complex social systems have to take into account the incremental dynamics in the incubation phase, a rapid dissemination of crisis communication in the contagion phase, and a relative (metastable) stabilization leading to social restructuring. As previously stated in section 1, we privilege two alternatives. First, we consider an adaptation of the bootstrap percolation model [30]. Given a network (a finite undirected graph) where nodes represent individuals and edges their communications, we initially consider every individual at state 0, and then, with a given probability distribution, we change one by one the state of the vertices from 0 to 1 (incremental dynamics of incubation). Once the state of a vertex has changed, we apply until convergence, the strict majority dynamics (dissemination in the contagion phase)—i.e., a node at state 1 remains stable and a node at state 0 changes if and only if the majority of its neighbors are at state 1. We apply this rule until a stationary state is reached (metastable restructuring). In particular, we are interested in the minimum number of nodes (or even a particular node) after which the whole society becomes infected (see section 4).

Second, we suggest an adaptation of the sand pile model [27]. As in the previous case, we consider a network (a finite undirected graph) where each node represents an individual that has the capacity to stock discrete information (tokens), and the edges represent their communications. If the number of tokens of one individual exceeds the number of its neighbors it gives one token to each neighbor. So, as in the previous model, initially there are no tokens in the network; then at each step a token is added randomly followed with a relaxation until a stable configuration is reached; after that, another token is added and so on. Therefore, for this model, the first part (adding tokens) is related to the incubation and the relaxation to contagion. Also, the relaxation may be considered as an *avalanche*, thus, the size of an avalanche can be considered as the spread of contagion.

Evidently, both discrete models are qualitative, and despite of their simplicity, they are complex enough such that under some assumptions fast prediction of their dynamics is not possible. Actually, for the first model (bootstrap percolation) given an initial condition, the problem of knowing faster (exponentially) if in a relaxation phase a given node could be infected is possible when the $\Delta(G) \leq 4$ (the maximum degree of the network), but it is hard when $\Delta(G) \geq 5$ (so in very interconnected societies the prediction is not really possible) [45]. Furthermore, for the sand pile if $\Delta(G) \geq 3$, then the problem of knowing exponentially faster if a given vertex will receive a token is hard [46].

4. DISCUSSION. THE CHILEAN CASE

In this section, we argue that Chilean society displays several of the features we have theoretically described above regarding crisis processes in complex social systems. For the sake of illustration, we concentrate on the consequences on the educational system—a highly complex system itself [47]. Firstly, we present a sociological framework for the case. Second, we propose a percolation model to analyze its dynamics.

4.1. The Framework

In the mid seventies, Chilean society under military rule (1973–1990) established the policy foundations for the *incubation of excesses* (compulsive growth) of the medium money that we can call *monetization* [36]. Monetization arises when deregulation policies foster tight couplings between money and non-economic fields. This creates emergent patterns of symbolic influence and operative interference (overflow and spillover effects) of money in other social systems that constrain their reflexive autonomy and reproduce segregation and social inequality. This process of monetization was implemented by an extended privatization program covering health care, pensions, universities, telecommunications, public transport, basic services, and school system, which produced a process of factual alienation to economically driven efficiency ends [48]. Consequently, the quality of services became dependent on payments of single persons or families, thereby leading to a generalized stratification of access to the services and outcomes of social systems [49].

Regarding the Chilean educational system, we consider three milestones for the incubation of the monetization process in education: (a) implementation of municipalization process in early 1980s—i.e., transferring the administration of public schools from central State to municipalities with strong differences in material and organizational resources; (b) introduction of voucher system in early 1980s—i.e., per-student government subsidy to both private (for profit) and public schools according to families' school choice plus school selection in subsidized schools; (c) introduction of co-payment mechanism in early nineties—i.e., subsidized schools receive additional payments from parents to supplement government voucher (shared financing). The literature has identified different emergent patterns arising from the implementation of these monetization policies in the Chilean educational system, such as consistent reduction of enrollment in public schools and increase of private schools [50], selection of students in private subsidized schools according to prior academic performance [51], socioeconomic school segregation [52], long-distance travels to assist to elite subsidized schools [53], regressive effects as a consequence of shared financing [54], and, as a general effect,

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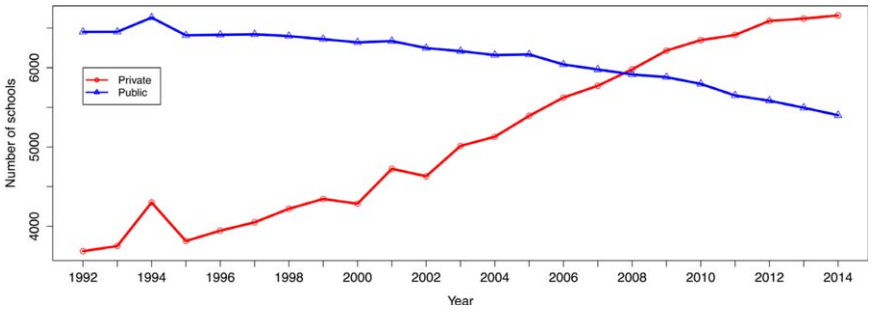
FIGURE 1



Evolution of the number of Chilean schools (public/private). Source: Own elaboration with data from The Chilean Ministry of Education

increasing stratification of educational achievements among public and private subsidized schools [55–57].

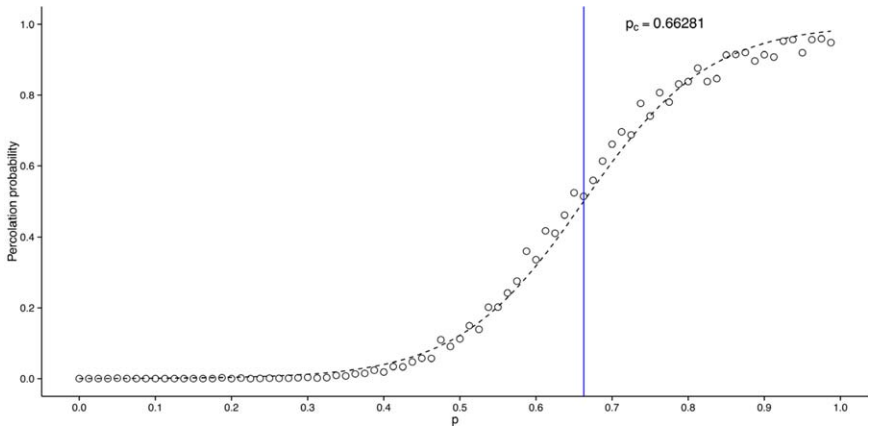
According to our theoretical framework, the above-mentioned policies set up the conditions for the incubation of monetization of education leading to repetitive escalation and spillover effects in the contagion phase such as segregation, regressive effects (stronger feedback, excess correlations), explosive number of private schools, and stratification of educational performances, thereby configuring a crisis in the educational system.

4.2. The Model

Considering this framework, we propose a percolation model to analyze this dynamics. We focus on the evolution of the number of schools (public and private) shown in Figure 1 since early nineties (introduction of shared financing, third milestone) as an observable of the system dynamics.

For this, let us consider an undirected graph (network) with n nodes, where each node represents a school (or a group of schools with similar characteristics such as the number of students, the number of teachers, socio-demographic behavior of the students, etc.) and the edges represent their communications. Each node can be either a private or a public school (which could be modeled with 0 and 1, respectively). For our simulations, we will consider randomly generated networks with an average degree around 3 (the number of connections of each node). Also, let us consider p, in the range of [0,1], a threshold value needed to change from private to public. This can be seen as an external parameter associated, for example, to public policies or any other type of incentives to change from one type of school to another. The

FIGURE 2



Percolation probability of the proposed model for different values of p

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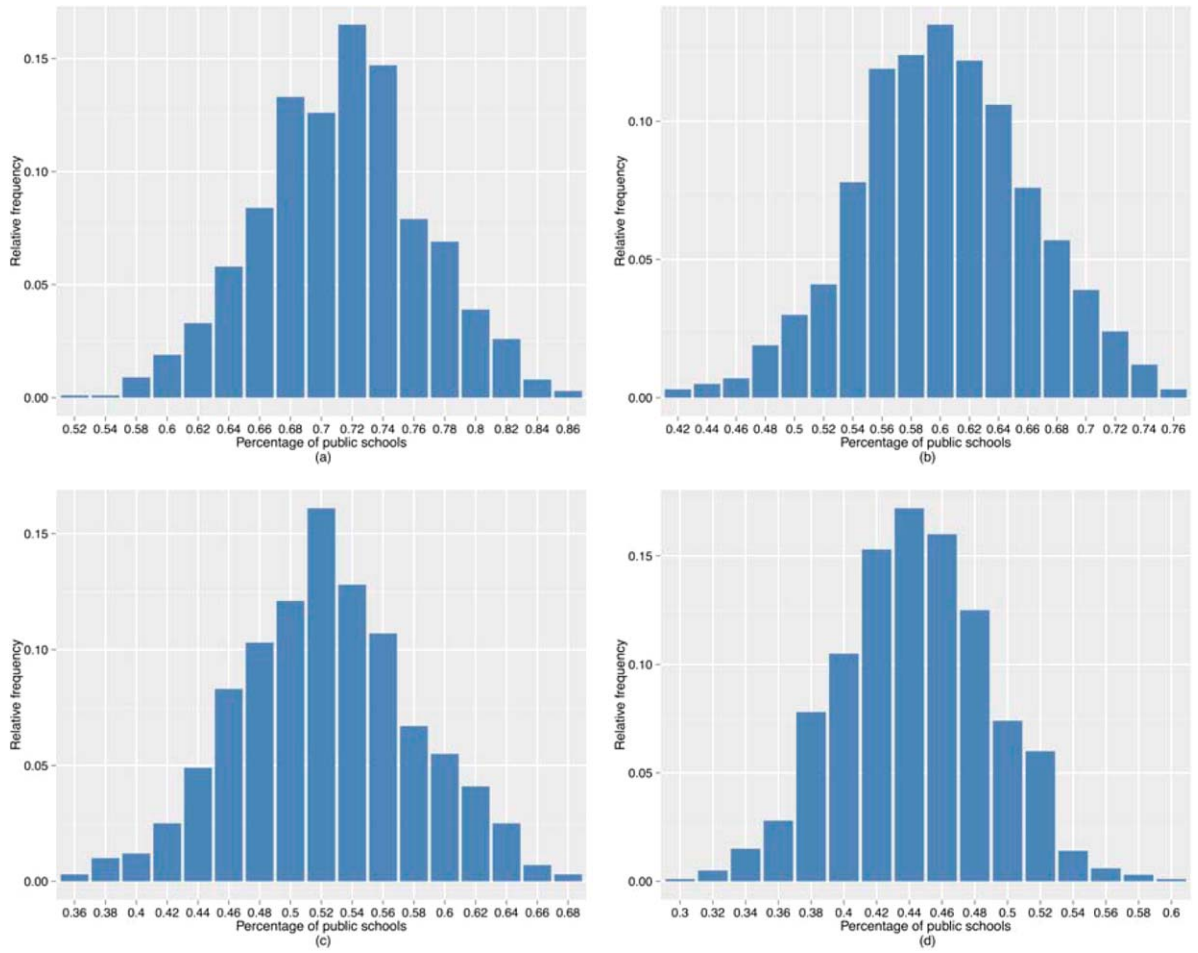
FIGURE 3



Distribution of percentages of public schools at year 2014 for (a) $p = 0.3$, (b) $p = 0.6$, (c) $p = 0.8$, and (d) $p = 0.99$

dynamics of the network is given by the following asynchronous updating scheme. Update rule:

> At each discrete time step, select randomly an edge.
> If the two nodes associated to the edge are the same type of school, then leave it as it is.
> Else, generate a random number r in the range of [0,1], if $r > p$ change the private school to public school, else, change the public school to private school.

For the proposed model, we would first like to find how common is for the model, starting from any configuration (incubation), to percolate completely to private schools (contagion), considering a full range of possible values for p. For this we have conducted the following simulation. We have considered 100 randomly initiated networks of $n = 16$ (nodes). For each network we repeat the following: we iterate the network 100 time-steps and register what fraction it fully percolated. This way, for each value of p, we report the average of the fraction (probability) of percolation of 100 networks. The result is shown in Figure 2. Also, by fitting a logistic model to these data an estimation of the percolation threshold $p_c = 0.66281$ was obtained. This means that beyond this critical value (phase transition to supercriticality), the velocity of percolation to private schools increases.

Let us consider the data shown in Figure 1, in percentages, therefore, for 1992, approximately 64% of the total schools were public and 36% private, then by 2014 the percentage of public schools had dropped to about 44%, and the private schools had increased to about 56% (see Figure 5). The idea is to see whether the proposed percolation model is capable of generating

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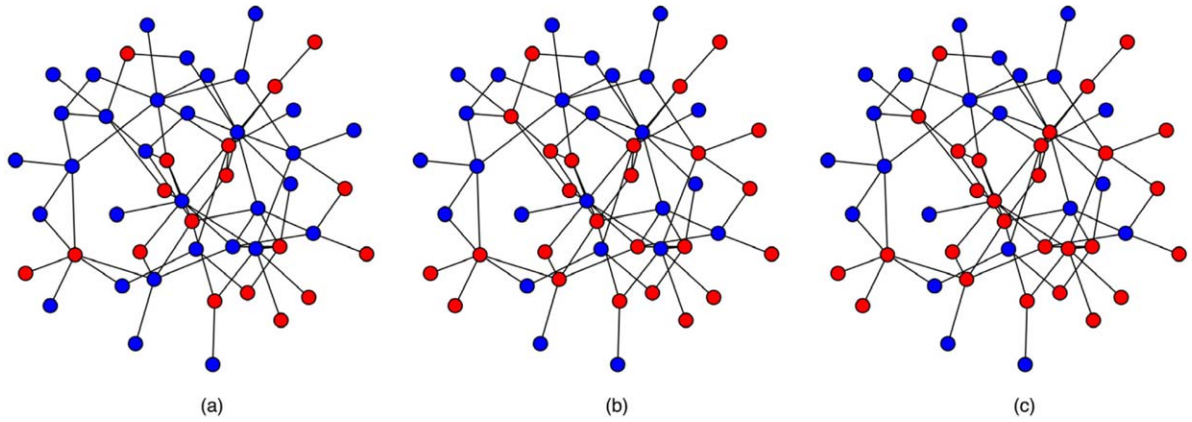
FIGURE 4



The blue nodes represent public schools and the red nodes represent private schools. (a) Configuration in 1992, (b) Configuration in 2008, and (c) Configuration for 2014

this evolution of schools through time, and how common is this dynamics and for what values of p. For this simulation, we have considered $n = 50$ and generated 1000 random networks, each of them was initialized randomly but with the proportion 64% of public schools (32 public nodes) and 36% of private schools (18 private nodes). We will consider that one update of the network represents one year, therefore, each network was updated 22 times to reach the year 2014. At the end of the iteration we recorded for each network the proportion of public schools. Figure 3 shows histograms with the results for (a) $p = 0.3$, (b) $p = 0.6$, (c) $p = 0.8$, and (d) $p = 0.99$, where the different values of p (threshold value needed to change from private to public) represent social barriers (public policies or other environmental incentives) for the transition from one state to another (0.3 low barriers in subcritical phase; 0.6 near to critical level; 0.8 supercriticality; 0.99 high barriers in supercritical phase).

From Figure 3 we notice that in the case of (a), as expected, for low values of p the number of public schools tend to increase most likely around 72% of the total schools, and none of the networks showed a final configuration as the Chilean data (44% of public schools). For (b) we see that the number of public schools starts to decrease been most likely around 60%, and the configuration exhibited by the Chilean case (44% of public schools) appears as a rare event with very low frequency. For (c) the number of public schools is most likely to be around 52%, and the Chilean case occurs less than 5% of the time. Only when we consider an extreme value of p we see in (d) that the Chilean case is most likely to occur.

From the previous results we can conjecture that the behavior exhibited in the Chilean data (44% of public schools in 2014 as shown in Figure 5) occurs most likely for values close to $p = 1$ (the model eventually fully percolates to private schools—Figure 3), which allows us to speculate that the incentives in Chile, either through monetization by means of public policies or some other environmental sources (prevailing value orientations in cultural *milieu*, symbolic influences through media, semantic expectations in community circles), was to reduce (eventually eliminate in the long run) public education and leave only private and subsidized schools in the Chilean schooling system. This high value of p could also explain why the government has not invested significantly to improve the quality of public education, thereby generating a large gap (inequality, segregation, regressive effects, stratification of school performance) between private and public schools in Chile.

In this simulation, we were only interested in the configuration of the network at the end of the iteration (year 2014). We have also analyzed the trajectory starting from 1992 to 2014. We have noticed that some of the networks that converged to 44% of public school showed a similar trajectory as the real data. As an example, Figure 4 shows one of these networks with (a) the initial configuration in year 1992, (b) the configuration for year 2008, and (c) the final configuration for year 2014. For this network, we show in Figure 5 the real data together with the prediction.

We notice from Figure 5 that using our simple percolation model, we are able to find a network and an updating sequence that simulates very closely the evolution of the Chilean schools and, therefore, the implicit features

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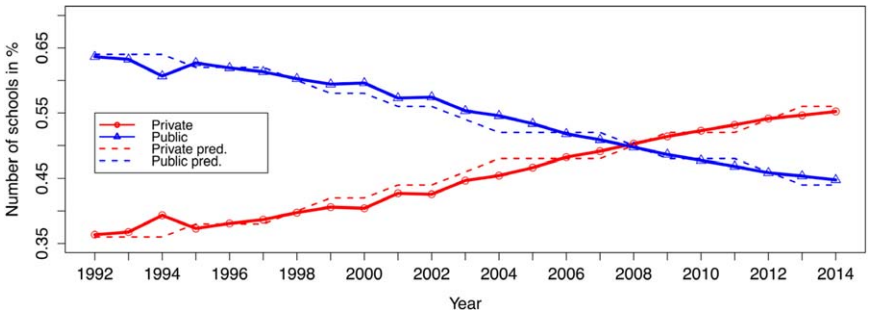
FIGURE 5



Evolution of the number of Chilean schools together with the prediction generated from the network of Figure 4

(inequality, segregation, regressive effects, stratification of school performance) of its general crisis dynamics.

The crisis situation triggered several protests particularly after 2011 [58], which recently led to a policy reform whereby the restructuring phase begins. The reform considers the end (from March 2016) of shared financing, the gradual end (from 2016 to 2019) of school selection of students according to prior academic performance, and the end of for profit organizations in the school system [59]. This means demonetization of the system and a new set of conditions for analyzing its social dynamics.

5. CONCLUSION AND FURTHER RESEARCH

In this article, we have developed some basic guidelines for a theory of crisis in complex social systems. We have suggested that, under given conditions, the quest for connectivity of communication engages social systems in a repetitive escalation dynamics—or logic of excess—whereby spillover effects for different systems or clusters in the network do emerge. This is the generative mechanism of crisis processes. We have also identified its main phase transitions, and some applicable modeling techniques.

Theoretically, further research must be conducted into the drivers of social crises. As seen, compulsive growth of systemic communication is one of them. Nonetheless, acceleration of modern life [60] seems to be a factor strongly related to events of communicative compulsive growth. Since in modern society social time is system-dependent (each system creates its own treatment of time in the form of orthogonal rhythms of acceleration and de-acceleration [2]), systems of higher acceleration rates such as economy, finance, or even politics, are prone to produce episodes of compulsive growth and engage in "multiple overlapping timescales" [61, p 3], thereby triggering temporality collisions among systems. A relevant source of increased oscillations in social relations, and therefore of crises, can be found here.

From an empirical point of view, further simulations concerning how the dynamics of compulsive growth turns into contagion of crisis and leads to a general restructuring of social situations have to be developed. Considering the neoliberal configuration of Chilean society over the last forty years, this case is particularly appropriate for analyzing spillover effects of the economic system upon other social fields. On the other hand, Chilean society is also a well-suited case for assessing policy reforms aiming at controlling those effects in a supercritical phase of restructuring—as in the policy reforms of education starting on March 2016.

Finally, in addition to the operative dimension of social crises computational models can bring into light, qualitative research (in-depth interviews, focus groups) on the shared experiences of actors and the interactional construction of meaning (sense-making) in crisis situations can also supplement the operative approach by introducing the semantic dimension of crises, offering thus a more complex, interdisciplinary view on complex social crises.

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