The Human Role Within Organizational Change: A Complex System Perspective

Tobias M. Scholz

1 Introduction

It can be difficult for organizations to survive through increasing and persistent change, whether it takes place internally or externally (Maguire et al. 2011). Organizations compete in a dynamic environment (Scholz 2012). In addition to the increase of complexity, the potential for solving problems becomes more and more restricted, e.g. through lack of retention due to the "war for talent" (Michaels et al. 2001).

Extreme changes (Eoyang 2011) lead to a system of constant reorganization and adaptation (Maguire et al. 2006). Organizations are still trying to solve problems based on simplification, predictability, equilibrium and linearity (Marion 1999). Barabási (2003:201) stated: "As companies face an information explosion and an unprecedented need for flexibility in a rapidly changing marketplace, the corporate model is in the midst of a complete makeover." Organizations therefore are complex systems and we have to move beyond reductionism (Barabási 2012). Such a turbulent shift, where change is the new stability (Farjoun 2010), will have a heavy toll on humans. Evidently the human is the cornerstone of any organizational change (Porras and Robertson 1992), therefore, we have to shift to people as key players (McKelvey 2004) and to take the human into the midst of the organizational change. Complex systems in organizations are influenced by the interaction among humans; focusing on the humans in such complex systems, therefore, becomes essential. Organizations are being forced to focus on the human factor (Pfeffer 2010).

This paper addresses the following question: how does the human role influence organizational change within a complex organization? Due to recent research (Barabási 2011) we can shift our attention to the people in an organization

T.M. Scholz (✉)
University of Siegen, Siegen, Germany
e-mail: tobias.scholz@uni-siegen.de

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(Goodwin 1994) and deal with complexity concerning unpredictability, non-equilibrium and non-linearity in modern organizations (Maguire et al. 2011). This paper aims to fill a research gap by examining the human role within organizational change using the perspective of complex systems research.

2 Key Concepts and Conventions

2.1 Perception of Complex Systems Within Organizations

Even though complex systems science (or complexity science) has a long history with roots in systems theory (von Bertalanffy 1968), chaos theory (Lorenz 1963) and cybernetics (Ashby 1956), the field is struggling to find a general definition, and therefore it is still a fragmented subject (Mitchell 2009). Lissack (1999) explained that the common notion of complex systems is that "within dynamic patterns there may be an underlying simplicity" (p. 112). Within only a span of 10 years, complex systems science — in the context of organization theory — has evolved from "remarkable new vistas" (Anderson 1999:229) to "it is time to change" (Andriani and McKelvey 2009:1068).

In order to analyze complex systems in the field of organizations, and particularly based on the dynamics of complex systems in organizational change, we must examine the perspective of complex systems relating to organizations and organizational change. Combining complex systems science and organizational change leads to a reframing of organizational change (Eoyang 2011). Changes in the environment have forced researchers to review traditional perspectives: "Everything that supported stability and continuity of organization was compromised" (Eoyang 2011:320).

For Eoyang (2011), the traditional (Newtonian) perspective is characterized by the following metaphors. Inertia means that without outside force no change happens. Resistance is where efforts of change will be opposed. Progress implies that there is a reachable end and that an organization moves towards it. Momentum is the idea of predictability on the path of change. Power implies that an organization is changeable, like a dormant object. Alignment means that there is a need for homogeneous commitment to only one goal. These metaphors seem to be relatively narrow and only vaguely applicable to the modern environment in which organizations are acting, and therefore they are insufficient (Hodge and Coronado 2007).

Following the state of uncontrollability and unpredictability, new metaphors are necessary. Based on a dynamic, non-linear and non-equilibrium organization, considering the bridge between complex systems science and organizational change seems to be a beneficial approach (Falconer 2002). Eoyang (2011) observed organizational change through the lens of complex systems science and found five metaphors to perceive complex systems in phases of organizational change: fractals, simple rules, self-organized criticality, emergence and adaptation.

Fractals are fragmented geographical objects that consist of smaller copies of the complete structure (Mandelbrot 1982). Based on self-similarity, a fractal can be generated through a non-linear equation iteratively (Falconer 1997). In the context of organizational change, fractals are a metaphor. One application is the iterative nature of fractals, and refers to the distribution of a uniform idea in an organization (Zimmermann and Hurst 1993). Bouchikhi and Kimberly (2003) ascertained that the concept of identity follows fractal patterns. Another approach is to look into the scale-free nature of fractal patterns and thus explore relationships, such as organizational management relationships in the phases of stability and change (Levick and Kuhn 2007).

Simple rules are also called minimum specifications, and these can result in system-wide patterns (Wolfram 2002). With these simple rules, it is possible to achieve harmonization in the phase of change and to minimize restrictions for individual members (Eoyang 2007). Even though this sounds relatively easy, it is essential to achieve a balanced approach to the freedom of individual members and general applicability of rules.

Self-organized criticality alludes to the general tension in an organization that constrains it in a similar way to gravity" (Bak 1996). In the context of organizational change, the "tipping point" (Gladwell 2002), the moment where the organization collapses, becomes relevant. However, this is only a punctuated equilibrium. Thus, self-organized criticality describes the organization and its dynamics based on several key elements, such as size and interactions. Introducing change into an organization may require time to overcome self-organized criticality before it can "break through into a new structure with surprising speed and clarity" (Eoyang 2011:323).

Emergence is the process of pattern creation through interaction among members of an organization, which differs from the general patterns formed in an organization. Swarm intelligence is a common example of emergence (Garnier et al. 2007). Even though emergence comes from the organization itself, it is possible to leverage and develop an emergence-friendly environment (Huy and Mintzberg 2003). Organizations need to achieve the right mix of top-down and bottom-up environments (Rowland 2004). Some examples that support emergence include defining factors and conditions such as social construction, adaptive factors, enabling infrastructures and control factors (Alaa 2009) and the influence of differences and exchanges (Eoyang 2011).

Adaptation is currently the aspect of complex systems that is most addressed in the context of organizational change. An organization seeks to fit into the environment and therefore has to adapt evolutionarily to internal and external patterns (Siggelkow 2002). Furthermore, an organization needs to establish an environment of co-evolution (Rindova and Kotha 2001) and thereby to improve its own survival chances. However, adaptation leads to tension between sustaining one's own features, and improvements through adaptation (Cilliers 2006).

In summary, these metaphors from complex systems science can be utilized for organizational change. They lead to constant tension in organizational change (Leana and Barry 2000) and the need to balance "both stability and flexibility,

both continuity and disruption, both ties to the old and stretches to the new" (Eoyang 2011:326). Balancing those competing demands and achieving synergies in stability and change is ambitious but possible (Farjoun 2010).

2.2 *Importance of Power Law Distribution*

When talking about complex systems it is necessary to introduce the power law distribution. This is also known as the Pareto distribution (Chauset et al. 2009). Contrary to the shape of the Bell curve in the normally distributed Gaussian distribution, the power-law distribution is characterized by a long tail (see Fig. 1). Essentially, a power-law distribution means that many small events coexist with few large ones (Barabási 2003). Thus, looking into power-law science means a fundamental shift from the average Gaussian distribution to the Pareto distribution. However, previous research is dominated by a Gaussian environment (Lawson 1997) and, therefore, focused on the average (McKelvey and Andriani 2005).

Figure 1 shows the differences in both distributions. Here, Barabási (2007) used examples of highways and airports in the US. These examples are striking, as both are manmade phenomena. However, a highway in general does not reveal its usage; based on the connections and due to the influence of architects, the majority of cities have the same number of connections. There is a difference if you look at airports. Some cities have airports consisting of many connections. Such airports are called "hubs" (Barabási 2003). For example, Atlanta is the busiest airport in the world (Jones 2011), but there is no simple explanation for this. Moreover, this example shows the complexity of the real world, and recent research shows that the Pareto distribution seems to be "more normal than [the] normal [distribution]" (Willinger et al. 2004:130). Andriani and McKelvey (2009) found over 100 power-law distributions in nature, especially for business-related organizations. For instance, power-law distributions can be found in job vacancies (Gunz et al. 2001), robustness in organizational networks (Dodds et al. 2003), entrepreneurship and innovation (Poole et al. 2000), productivity of innovation (Jones 2005), work incapacity from back pain (Schmid 2004) and decision making and queuing (Barabási 2005). This number will increase; the recent research about power-law distributions in organizational communication networks during a crisis is exemplary (Uddin et al. 2011). Researchers will find more power-law distributions as the world changes towards greater customization (Anderson 2006); further, in order to achieve competitive advantage, the mean is not appealing but instead the successful loners (Andriani and McKelvey 2011).

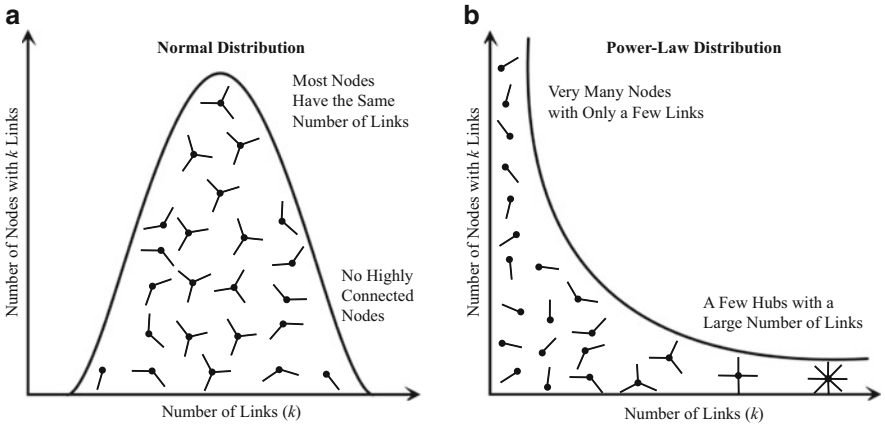

Fig. 1 Normal (Gaussian) distribution and power-law (Pareto) distribution. Own source. Based on: Barabási 2007

3 Theoretical Extension Towards Human Role

3.1 Need for Extension Towards Human Role

These changes in perception are still rooted in a static world. However, similarly to the dynamics in the environment, change processes succeed or fail due to the humans who are involved (Ford and Ford 1995). Several researchers state that nearly two thirds of change projects fail (Burke and Biggart 1997; Beer and Nohria 2000) and this number could be even larger (Burnes 2004). It seems that "change in the individual organizational member's behavior is at the core of organizational change" (Porras and Robertson 1992:724) and therefore the individual is not only a passive recipient of change (Greenhalgh et al. 2004). It is necessary to reach for individual readiness for organizational change (Choi and Ruona 2011) and it is evident that this individual readiness will impact the organization and the organizational change due to the heavy influence of human interaction (Boisot and McKelvey 2011). On the micro level the behavior of individuals differs from each other and we should emphasize that (Greenhalgh et al. 2004). On the macro level, and in the accumulation of individual perspectives, we can pick up the argument about distributions.

Humans on a macro level will follow a Gaussian, or normal, distribution. Gaussian, distribution is the traditional approach and means a focus on the average. Still though within the workforce of an organization this means a focus on the majority of people, and thereby neglecting outliers (Andriani and McKelvey 2011). Contrary to the Pareto distribution or the Power Law distribution, the outliers will have a stronger influence. Outliers will be the important people in such a distribution.

In order to systematically compare both distributions it is necessary to define the environment. Based on the findings presented earlier in this paper, it is possible to comprehend a complex system (Eoyang 2011). Fractals, simple rules, self-organized criticality, emergence and adaption enable an understanding of a complex system and, in addition, provide a setting to analyze the human role within an organization. Furthermore, the characterization of a complex system based on Cilliers (1998) is sufficient so that both distributions can be applied and analyzed.

3.2 Normal (Gaussian) Distribution vs. Power-Law (Pareto) Distribution

Importantly, the logic of a complex system ascertains that a normal distribution can exist within a complex system. Based on combination theory, several components of a complex system can have different distributions, but the complex system follows, in any case, a power-law distribution (Newman 2005). This theory allows us to compare both distributions within the features of a complex system and to administer the effects of both distributions on the human role within an organization. Based on preliminary research (Scholz 2013) we can combine both distributions with the dimensions of Eoyang (2011); thereby obtaining the following aspects as stated in Table 1.

3.3 Fractals

In the case of Gaussian fractals there is a general trend towards centralization within the human network. Even though processes are constantly fluctuating, in general all humans tend towards an average and common environment. Change processes should be accepted by a majority and should be commonly spread. By contrast, Paretian fractals are about decentralization. It is therefore not the goal of a change process to convince a nominal majority. In fact different change processes constantly compete against each other and through interaction they will be developed further. It is not essential that over 50 % of the people in an organization are convinced, but that the people acting as a hub are convinced. Persuading enough hubs will be sufficient for the change process as other people will follow in a Paretian distribution.

Table 1 Human Resource Management under the assumption of normal distribution or power-law distribution

	Normal (Gaussian) Distribution (Average)	Power-law (Pareto) Distribution (Extremes)
Fractals	Centralization	Decentralization
Simple rules	Order	Disorder
Self-organized criticality	Attack tolerance	Error tolerance
Emergence	Convergence	Divergence
Adaptation	Adjustment to the average	Adjustment to the outliers

3.4 Simple Rules

In the Gaussian distribution simple rules tend more towards order. Focusing on the core competences and core tasks, those simple rules have to establish the environmental setting. Well defined rules and structures help to generate some stability in a change process, and eventually order. This will give security for humans and something they can rely on. By contrast, Paretian simple rules are more disorderly. Contrary to the Gaussian world, rules are simpler, general and tend to be minimalistic. Essentially disorder helps in a change process to generate the necessary flexibility. Through the change process a new general order emerges, however, and new rules are established. Such flexibility means that every human in the change process can contribute to the process and is not limited by rules focusing on order.

3.5 Self-Organized Criticality

Gaussian self-organized criticality centers around the attack tolerance of human networks. Albert et al. (2000) explain that Gaussian distribution has a high attack tolerance. In this case attack means specific removal of parts in a system. In a change process such a behavior is similar to the removal of people who may resist change. However the self-organized criticality or tipping point are not reachable through removal. An organization following the Gaussian distribution will not be influenced by such an approach to change processes. On the contrary, in Paretian self-organized criticality there is a higher error tolerance (Albert et al. 2000), and therefore randomly removing parts of the system will not have great influence. However the attack tolerance is significantly lower in a Paretian distribution. In this distribution it will be beneficial to remove the hubs that are resisting the change process. Persuading a resisting hub will improve the change process substantially.

3.6 Emergence

Gaussian emergence leads to convergence characteristics. Interactions within the human network generate a concentration towards similarities. Based on this process of emergence humans adapt towards each other and strive to an alignment, leading to a network that adjusts towards convergence, but also reducing the variety and differences within the network. This makes the process of change, in the long run, nearly impossible. By contrast, Paretian emergence is the process of divergence. Diversity is an essential part of the human network and therefore divergence rises through emergence. It leads to a variety of different and parallel emergent processes. This increases the complexity within a human network and makes change processes in the beginning problematic, but the competing emergent processes will improve over time, making it easier to find the right change.

3.7 Adaptation

Gaussian adaption is the process of adjustment towards the average. The human network is therefore focused on establishing change that helps the majority within an organization. Adapting to the average leads to a neglect of extreme processes and the interests of outliers who could be even better for the organization. However due to the human role within the organization the current interest of the majority at this moment is essential. Such a process can lead to less resistance within a change process via a majority of supporters. Paretian adaptation focuses on the outliers and potentially the hubs within the human network. Based on a constant interaction with key players in the organization (essentially the top management) the necessary change processes are questioned, planned and implemented. This is leads to an evolutionary change process that balances processes within an organization and adapts to relevant hubs.

In summary, both distributions lead to different changes and obstacles. It becomes apparent that knowledge about the humans within the complex system of an organization is essential. Furthermore both distributions are striving in different directions. This inherent pursuit leads to a different strategy in the change process. In addition, a strategy focusing on the wrong distribution could quickly fail.

4 Discussion

Even though complex systems theory can describe current developments in an organization (Marion and Uhl-Bien 2011) and seems to be closer to the practitioners' world (Andriani and McKelvey 2009), research is still struggling with an

applicable research method (Andriani and McKelvey 2009). Recent developments such as reality mining (Pentland 2010) and dynamic network analysis (Carley et al. 2007) could be ways to close the gap between theory and practice.

It needs to be remembered that the paradigm shift behind complex systems science is fundamental (Andriani and McKelvey 2011) and, if adapted, change processes could help to understand the problems of change processes. Looking at the phenomenon in addition to a normal distribution and more towards extremes and power-law distribution (e.g. cultural diversity or high potential) seem to be even more promising. The human role becomes the centerpiece of the change process, especially through the fitting distribution. Change following the distribution will lead to more stability (Leana and Barry 2000).

Hence it seems comprehensible that different constellations of human interactions lead to different behaviors and consequently to different distributions. Furthermore, such distributions lead to different insights for organizational change strategy. But the next question for research will be: which distribution does the human behavior within an organization follow? It is questionable whether current methods are sufficient, but new technologies such as Big Data (Simon 2013) could be helpful in this question. Importantly, those distributions are not static, or can't be described as fixed. Human interaction and therefore the human role within an organization changes dynamically. In addition to the question of the distribution it is also necessary to constantly monitor the distribution and changes in the human network.

As we can see in current research, change management is struggling and present methods seem to be insufficient. Complex systems are changing dynamically, especially in situations concerning humans. Change is therefore constantly happening and interactions between humans are essential for success.

5 Conclusion

Complex systems are the future of organizational studies (Andriani and McKelvey 2009) and already describe many phenomena in that field. Still, application to organizations is under-researched (Andriani and McKelvey 2009), while the controllability of complex systems is still highly theoretical (Liu et al. 2011). Even though power-law distributions are found in an increasing number of phenomena, it is questionable whether a benefit, not to mention competitive advantage, is designable and economically achievable. Furthermore, it is not obvious that the humans within an organization consequently follow power laws, rather it depends on the human network. Evidently knowledge about distribution within an organization is critical information.

This paper shows that the human role is essential for organizational change and that an organization has to be professional (Stein 2010). An organization has to look into the behavior of humans within the complex system. Based on such an adaption of, in this case, the distribution of an organization, results in insights into how to act

concerning a change strategy. It is then possible to achieve stability within change even in an unpredictable, far from equilibrial and non-linear environment, and this is achieved through the humans involved in the change process.

References

Alaa, G. (2009). Derivation of factors facilitating organizational emergence based on complex adaptive systems and social autopoiesis theories. *Emergence: Complexity & Organization, 11*(1), 19–34.

Albert, R., Jeong, H., & Barabási, A.-L. (2000). Error and attack tolerance of complex networks. *Nature, 406*, 378–382.

Anderson, P. (1999). Complexity theory and organization science. *Organization Science, 10*(3), 216–232.

Anderson, C. (2006). *The long tail*. London: Random House.

Andriani, P., & McKelvey, B. (2009). From Gaussian to Paretian thinking: Causes and implications of power laws in organization. *Organization Science, 20*(6), 1053–1071.

Andriani, P., & McKelvey, B. (2011). Managing in a Pareto world calls for new thinking. *Management, 14*(2), 89–118.

Ashby, R. W. (1956). *An introduction to cybernetics*. London: Methuen.

Bak, P. (1996). *How nature works: The science of self-organized criticality*. New York: Copernicus.

Barabási, A.-L. (2003). *Linked: How everything is connected to everything else and what it means for business, science, and everyday life*. London: PLUME.

Barabási, A.-L. (2005). The origin of bursts and heavy tails in human dynamics. *Nature, 435*, 207–211.

Barabási, A.-L. (2007). The architecture of complexity. *IEEE Control Systems Magazine, 27*(4), 33–42.

Barabási, A.-L. (2011). *Bursts: The hidden patterns behind everything we do, from your E-Mail to bloody crusades*. London: PLUME.

Barabási, A.-L. (2012). The network takeover. *Nature Physics, 8*, 14–16.

Beer, M., & Nohria, N. (2000). Cracking the code of change. *Harvard Business Review, 78*(3), 133–141.

Boisot, M., & McKelvey, B. (2011). Connectivity, extremes, and adaptation: A power-law perspective of organizational effectiveness. *Journal of Management Inquiry, 20*(2), 119–133.

Bouchikhi, H., & Kimberly, J. (2003). The rhythm of change: Escaping the identity trap. *MIT Sloan Management Review, 44*(3), 20–26.

Burke, W. W., & Biggart, N. (1997). Interorganizational relations. In D. Druckman, J. E. Singer, & H. Van Cott (Eds.), *Enhancing organizational performance* (pp. 120–149). Washington, DC: National Academy Press.

Burnes, B. (2004). *Managing change: A strategic approach to organisational dynamics*. London: Prentice Hall.

Carley, K. M., Diesner, J., Reminga, J., & Tsvetovat, M. (2007). Toward an interoperable dynamic network analysis toolkit. *Decision Support Systems, 43*(4), 1324–1347. doi:10.1016/j.dss.2006.04.003. http://www.sciencedirect.com/science/article/pii/S0167923606000601#.

Chauset, A., Shakizi, C. R., & Newman, M. E. J. (2009). Power-law distributions in empirical data. *SIAM Review, 51*(4), 661–703.

Choi, M., & Ruona, W. E. A. (2011). Individual readiness for organizational change and its implications for human resource and organization development. *Human Resource Development Review, 10*(1), 46–73. doi:10.1177/1534484310384957. http://hrd.sagepub.com/content/10/1/46.

Cilliers, P. (1998). *Complexity and postmodernism: Understanding complex systems*. London: Routledge.

Cilliers, P. (2006). On the importance of a certain slowness. *Emergence: Complexity & Organization, 8*(3), 105–112.

Dodds, P. S., Watts, D. J., & Sabel, C. F. (2003). Information exchange and the robustness of organizational networks. *Proceedings of the National Academy of Sciences of the United States of America, 100*(21), 12516–12521.

Eoyang, G. H. (2007). Human system dynamics: Complexity-based approach to a complex evaluation. In B. Williams & I. Iman (Eds.), *Systems concepts in evaluation: An expert anthology* (pp. 75–88). Point Reyes: Edge Press.

Eoyang, G. H. (2011). Complexity and the dynamics of organizational change. In P. Allen, S. Maguire, & B. McKelvey (Eds.), *The SAGE handbook of complexity and management* (pp. 317–332). Thousand Oaks: Sage.

Falconer, K. (1997). *Techniques in fractal geometry*. Hoboken: Wiley.

Falconer, J. (2002). Emergence happens! Misguided paradigms regarding organizational change and the role of complexity and patterns in the change landscape. *Emergence, 4*(1/2), 117–130.

Farjoun, M. (2010). Beyond dualism: Stability and change as a duality. *Academy of Management Review, 35*(2), 202–225.

Ford, J. D., & Ford, L. W. (1995). The role of conversations in producing intentional change in organizations. *Academy of Management Review, 20*(3), 541–570.

Garnier, S., Gautrais, J., & Theraulaz, G. (2007). The biological principles of swarm intelligence. *Swarm Intelligence, 1*(1), 3–32.

Gladwell, M. (2002). *The tipping point*. Boston: Back Bay Books.

Goodwin, B. (1994). *How the leopard changed its spots: The evolution of complexity*. New York: Charles Scribner's Sons.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *Milbank Quarterly, 82*(4), 581–629.

Gunz, H., Lichtenstein, B. B., & Long, R. (2001). Self-organization in career systems: A view from complexity science. *Management, 5*(1), 63–88.

Hodge, B., & Coronado, G. (2007). Understanding change in organizations in a far-from-equilibrium world. *Emergence: Complexity & Organization, 9*(3), 3–15.

Huy, Q., & Mintzberg, H. (2003). Rhythm of change. *MIT Sloan Management Review, 44*(4), 79–84.

Jones, C. I. (2005). The shape of production functions and the direction of technical change. *Quarterly Journal of Economics, 120*(2), 517–549.

Jones, C. (2011). *Atlanta still world's busiest airport; Beijing passes Heathrow as No. 2*. http://travel.usatoday.com/flights/post/2011/03/atlanta-still-worlds-busiest-airport-beijing-passes-heathrow-as-no-2/148084/1. Accessed on January 08, 2012.

Lawson, T. (1997). *Economics and reality*. London: Routledge.

Leana, C., & Barry, B. (2000). Stability and change as simultaneous experiences in organizational life. *Academy of Management Review, 25*(4), 753–760.

Levick, D., & Kuhn, L. (2007). Fractality, organizational management, and creative change. *World Futures: The Journal of General Evolution, 63*(3/4), 265–274.

Lissack, M. R. (1999). Complexity: The science, its vocabulary, and its relation to organizations. *Emergence, 1*(1), 110–126.

Liu, Y.-Y., Slotine, J.-J., & Barabási, A.-L. (2011). Controllability of complex networks. *Nature, 473*, 167–173.

Lorenz, E. N. (1963). Deterministic nonperiodic flow. *Journal of Atmospheric Sciences, 20*(2), 130–141.

Maguire, S., Allen, P., & McKelvey, B. (2011). Complexity and management: Introducing the SAGE handbook. In P. Allen, S. Maguire, & B. McKelvey (Eds.), *The SAGE handbook of complexity and management* (pp. 1–26). Thousand Oaks: Sage.

Maguire, S., McKelvey, B., Mirabeau, L., & Öztas, N. (2006). Complexity science and organization studies. In S. R. Clegg, C. Hardy, T. B. Lawrence, & W. R. Nord (Eds.), *The SAGE handbook of organization studies* (pp. 165–214). Thousand Oaks: Sage.

Mandelbrot, B. B. (1982). *The fractal geometry of nature*. New York: W. H. Freeman.

Marion, R. (1999). *The edge of organization: Chaos and complexity theories of formal social organizations*. Thousand Oaks: Sage.

Marion, R., & Uhl-Bien, M. (2011). Implications of complexity science for the study of leadership. In P. Allen, S. Maguire, & B. McKelvey (Eds.), *The SAGE handbook of complexity and management* (pp. 385–399). Thousand Oaks: Sage.

McKelvey, B. (2004). "Simple rules" for improving corporate IQ: Basic lessons from complexity science. In P. Andriani & G. Passiante (Eds.), *Complexity theory and the management of networks* (pp. 39–52). London: Imperial College Press.

McKelvey, B., & Andriani, P. (2005). Why Gaussian statistics are mostly wrong for strategic organization. *Strategic Organization, 3*(2), 219–228.

Michaels, E., Handfield-Jones, H., & Axelrod, B. (2001). *The war for talent*. New York: McGraw Hill.

Mitchell, M. (2009). *Complexity—A guided tour*. New York: Oxford University Press.

Newman, M. E. J. (2005). Power laws, Pareto distributions and Zipf's law. *Contemporary Physics, 46*(5), 323–351.

Pentland, A. (2010). *Honest signals: How they shape our world*. Cambridge: MIT Press.

Pfeffer, J. (2010). Building sustainable organizations: The human factor. *Academy of Management Perspectives, 24*(1), 34–45.

Poole, M. S., Van de Ven, A. H., Dooley, K., & Holmes, M. E. (2000). *Organizational change and innovation processes: Theory and methods for research*. New York: Oxford University Press.

Porras, J. I., & Robertson, P. J. (1992). Organizational development: Theory, practice, and research. In M. D. Dunnette & L. M. Hough (Eds.), *Handbook of industrial & organizational psychology* (pp. 719–822). Palo Alto: Consulting Psychologists Press.

Rindova, V., & Kotha, S. (2001). Continuous morphing: Competing through dynamic capabilities, form, and function. *Academy of Management Journal, 44*(6), 1263–1281.

Rowland, G. (2004). Designing with: A homeopoietic ethic for organizational change. *Systems Research and Behavioral Science, 21*(3), 219–227.

Schmid, L. (2004). Are living beings in a state of self-organized criticality? A new interpretation of data on work incapacity due to low back pain. *Medical Hypotheses, 62*(3), 458–461.

Scholz, T. M. (2012). Dynamische Sprache für ein dynamisches Personalmanagement: Eine Anforderungsanalyse. In V. Stein, & S. Müller (Eds.), *Aufbruch des strategischen Personalmanagements in die Dynamisierung* (pp. 291–296). Baden-Baden and München: Nomos and Vahlen.

Scholz, T. M. (2013). Complex systems in organizations and their influence on Human Resource Management. In T. Gilbert, M. Kirkilionis, & G. Nicolis (Eds.), *Proceedings of the European conference on complex systems* (pp. 745–750). Heidelberg: Springer.

Siggelkow, N. (2002). Evolution toward fit. *Administrative Science Quarterly, 47*(1), 125–161.

Simon, P. (2013). *Too big to ignore—The business case for big data*. Hoboken: Wiley.

Stein, V. (2010). Professionalisierung des Personalmanagements: Selbstverpflichtung als Weg. *Zeitschrift für Management, 5*(3), 201–205.

Uddin, S., Murshed, S. T. H., & Hossain, L. (2011). Power-law behavior in complex organizational communication networks during crisis. *Physica A: Statistical Mechanics and its Applications, 390*(15), 2845–2853.

von Bertalanffy, L. (1968). *General system theory*. New York: Braziller.

Willinger, W., Alderson, D., Doyle, J. C., & Li, L. (2004). More 'normal' than normal: Scaling distributions and complex systems. In R. G. Ingalls, M. D. Rossetti, J. S. Smith, & B. A. Peters (Eds.), *Proceedings of the 2004 Winter Simulation Conference* (pp. 130–141). Piscataway: IEEE Press.

Wolfram, S. (2002). *A new kind of science*. Champaign: Wolfram Media.

Zimmermann, B., & Hurst, D. (1993). Breaking the boundaries: The fractal organization. *Journal of Management Inquiry, 2*(4), 334–355.