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Running Head: GROUNDED THEORIES OF FAMILY COMPLEXITY

From 1st and 2nd Order Cybernetics to Complexity: Building Grounded Theories of Family Complexity in Family Therapy Process Research

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Abstract

Family therapy has advanced, since its inception, in close connection with systems' sciences and cybernetics. However, it has not kept up with the new developments in Complexity sciences. In this paper, we propose that the core concepts of Complexity may be worth inspecting, although with caution, to help the field develop a deeper understanding of therapeutic family dynamics. Inspired by Complexity approaches we propose the adoption of a research program aiming to understand family complexity. Specifically, we propose, as a first step, the use of grounded theory, guided by complexity concepts, to identify and describe core coordination variables, control parameters, dynamical patterns and pattern dynamics of therapeutic family change. We defend that these Grounded Theories of Family Complexity may then provide a foundation mathematical modeling of family change processes.

Keyword: complex system; complexity; family therapy process research; grounded theory; family dynamics

Resumo

A terapia familiar avançou, desde o seu início, em estreita conexão com as ciências dos sistemas e a cibernética. Mas não acompanhou os novos desenvolvimentos nas ciências da Complexidade. Neste artigo propomos que os conceitos chave da complexidade podem merecer ser inspecionados, embora com cautela para ajudar o campo a desenvolver uma melhor compreensão das dinâmicas familiares terapêuticas. Inspirados pelas abordagens da Complexidade propomos a adoção de um programa de investigação voltado para compreender a complexidade familiar. Especificamente propomos, como primeiro passo, o uso da grounded theory, orientada para identificar e d escrever variáveis de coordenação chave, parâmetros de controlo, padrões dinâmicos e dinâmicas de padrão da mudança terapêutica familiar. Defendemos que estas Grounded Theories da Complexidade Familiar podem, então, oferecer uma fundação para a modelagem matemática de processos de mudança familiares.

Keyword: sistema complexo; complexidade, investigação de processo em terapia familiar; grounded theory; dinâmicas familiares

From 1st and 2nd order cybernetics to Complexity: Building grounded theories of family complexity in family therapy process research

Family therapy was greatly inspired decades ago by the sciences of systems and cybernetics. In this article, we call attention to the delay of the field in catching up and incorporating more recent developments in biological, physical, chemical, informational and computational sciences, among others, under the scope of a meta-theoretical framework of Complexity science. We aim to do so while recalling Francisco Varela's (1989) advice of caution in regard to the circulation of concepts between these fields. Nonetheless, we hope to highlight the potential value of contributions of Complexity for family therapy process research.

Understanding families and family change: 1st and 2nd order cybernetics

Early family therapy drew on core concepts from Cybernetics and General Systems Theory to build its foundations. But the early understanding of family processes was short due to the first cybernetics focus on stability and the narrowed focus of each therapeutic school.

Second order cybernetic valued the role of the observer as part of the system being observed and called therapists to be reflective of their role (von Foerster, 2003) and attend to the system's autonomy while recognizing their dependence of their milieu through structural coupling (Maturana & Varela, 1992). Positive feedback and its role in the amplification of change slowly earned their place (Maruyama, 1963).

The postmodern turn highlighted the role of language and social discourses in the negotiation and construction of the realities people lives (Friedman, 1993). New techniques and a more collaborative and respectful stance towards families were incorporated in family therapy. Still, the family as system was no longer much of a subject (Minuchin, 1998). Maybe it needs not to be so in the same way as it was in the old days but perhaps there are advantages in analyzing the family as a complex, multidimensional, system. We believe the family can be conceptualized as a domain of multiple (and multidimensional) forms of coordination and practices (Kelso, 1995; Kelso & EngstrØm, 1995, Varela, 1989), where, at least, behaviors, emotions, cognition, discourses, play an important role.

We still seem to be looking for that thing "in the bushes" (Hoffman, 1981, p. 176) without really understanding exactly what changes when the family changes, why it changes, how it changes and how we can know it. Concepts of first and second order change (Watzlawick, Weakland & Fisch, 1974) were proposed but little research has explicitly investigated them so are still short of operational definitions (Davey, Davey, Tubbs, Savlad, & Anderson, 2012).

Into Complexity

In the last decades, there have been profound changes in the physical and life sciences in face of the remarkable capacity of open systems for complex pattern formation and the spontaneous creation of order, through self-organization (Érdi, 2008; Mitchell, 2009). Family therapy frequently pays tribute to the legacy of Maturana and Varela (1992) and the work of Prigogine (Prigogine & Stengers, 1984) for informing our conceptualization of family change. But many others (e.g. Bak, 1996; Haken, 1981, Kauffman, 2008; Kelso, 1995; Thom, cit by Érdi, 2008) have made remarkable contributions in the creation of a new space for scientific inquiry focused in complex systems to which we will simply call Complexity).

Complex systems are diverse but tend to be characterized by the self-organized emergence of complex structural and functional patterns of organization and behavior from the nonlinear interaction of its simple components (Érdi, 2008). Many such systems adaptive changing their collective behavior dynamically through learning and evolutionary processes without central control (Eidelson, 1997; Mitchell, 2009).

Nonlinearity is a mark of complex dynamical systems meaning that changes are not proportional to the perturbations but are dependent on the system's structure and history. Nonlinear dynamics and other branches of mathematics have been used describe and represent the behavior of complex dynamical systems (Pismen, 2006; May, 1976).

We next briefly review some selected basic concepts of the lexicon of Complexity. For a quick overview of some of these basic concepts the reader may consult other sources (e.g. Érdi, 2008; Izhikevich, 2011; Mitchell, 2009).

Components and levels of analysis

A complex system has many interacting components and levels of analysis. The researcher needs to identify and situate the relevant variables at a given interaction level, and then look down to the systems' constituents and up to macroscopic emergent order parameters (Kelso & EngstrØm, 2006).

Emergence and Self-organization

Complex structures emerge from the nonlinear interactions of simple constituents, through self-organization (Haken, 1981; Mitchell, 2009) or the spontaneous, and sometimes apparently "purposeful formation of spatiotemporal structures" (Haken, 2008) through which there is conservation of a system's organization (Maturana & Varela, 1992).

Autopoiesis is a special form of self-organization through which systems organize their internal structure autonomously in a self-referential, recursive and self-assembled network of relations (organizational closure) which assures internal coherence. The systems' activities also aim at its self-maintenance so there is recurrent reentrance of its own products (operational closure) (Maturana & Varela, 1992).

Coordination dynamics

Coordination dynamics is "a set of context-dependent laws and rules that describe, explain, and predict how patterns of coordination form, adapt, persist, and change in natural systems" (Kelso & EngstrØm, 2006, p. 90). According to Kelso, it aims to explain the nature of functional and informational couplings within a system, between systems and between different kinds of things. A distinctive feature of this approach is that self-organization in living beings is thought to be based on functional information which, being "meaningful and specific to any kind of coordinated activity" (Ib., p. 98), lies in the internal and external coupling processes becoming meaningful when leading to changes in coordination patterns. This concept is close to the Batesonian idea of information as "the news of a difference" (Bateson, 1979, p. 32).

Order parameters/coordination variables

Order parameter (Haken, 1981) or coordination variables (Kelso, 1995, 2006) correspond to the higher order, macroscopic variables which characterize and explain a complex system's behavior and its change of states. They are most easily detected near non-equilibrium transitions and represent the meaningful, context-sensitive information which a system uses in coordination (Kelso, 1995). Once formed they "enslave" the systems components and constrain their behavior (Haken, 1981).

Circular/reciprocal causality/enslaving principle

Circular causality is a core concept in systemic family therapy. Drawn from early cybernetics it refers to the bidirectional influences of the systems' components on each other and could be regarded as a kind of horizontal causality. But interactions between more than two components, as in families, are astonishingly more complex. Therefore, simple circular feedback loops may not be the best way to understand interactional dynamics in complex living systems (Kelso, 1995).

In Complexity, circular causality is understood as a two-way, multilevel process from which the lower components of the system contribute to the emergence of higher macroscopic levels (bottom-up causality) and these influence the former (top-down causality). This kind of causality is not necessary symmetrical and some authors prefer to call it reciprocal causality (Thompson & Varela, 2001). We shall call it reciprocal vertical causality or complex causality.

Nested time-scales

Complex systems operate at different, nested, timescales. Quantitative changes in a system's lower levels of organization happen earlier and more rapidly than the qualitative changes observed at more macroscopic levels (Kelso, 1995)

Fluctuations

A systems' behavior is subject to fluctuations and dynamical instabilities (Kelso & EngstrØm, 2006), central adaptive processes which probe the system to find more adaptive solutions (Prigogine & Stengers, 1984). The time a system takes to recover from a perturbation and return to a steady state provides a measure of the system's robustness, signaling different types of change.

Bifurcations

Bifurcations occur at critical points when the system's fluctuations exceed a threshold for stability and it faces the inevitability of qualitative change (Guckenheimer, 2007; Prigogine & Stengers, 1984). There are different typologies of bifurcations creating alternative steady states (attractors) which the system may choose.

Self-organized criticality

Complex systems may self-organize into critical states where they are better understood as a collective phenomenon, sustained by the collaborative interaction of its elements (Bak, 1996; Kauffman, 2008) and where small disturbances can lead to consequences of catastrophic proportions. Criticality is a sort of boundary between states. Rigidly ordered systems show minimal fluctuations and, therefore, a reduced potential for change. Chaotic systems seem never to settle on a solution, reacting strongly to tiny fluctuations, with no memory (Bak, 1996). Dynamically critical systems, at the "edge of chaos", show a mixture of both order and disorder (Kauffman, 2008). They are more structurally stable but capable of fluctuations and change (Kauffman, 2008).

Control parameters

Control parameters drive the systems' collective variables through bifurcations. In biological and human systems they may be specific, informational and context-dependent (Kelso, 1995).

Equations of motion

Equations of motion describe the trajectories of the system through state space as a function of given parameters. Nonlinear differential equations are normally used to portrait complex systems' dynamics.

Degrees of freedom

Degrees of freedom correspond to the dimensions (variables) needed to characterize a system in a state or phase space. As the system self-organizes and novel patterns emerge the number of degrees of freedom is reduced.

Phase transitions

Just as elements such as water may be found in diverse states, depending on control parameters such as temperature, other systems can be found in different states. Different kinds of nonlinear transitions characterize living systems (Kelso, 1995).

Attractor

Attractors are regions in the phase or state space (points, periods, quasi-periods or chaotic orbits) towards which the system's trajectories evolve (Pismen, 2006). A region of orbits which tend to converge to a given attractor is a basin of attraction (Milnor, 2006). Repellers are unstable steady states where the system will deviate from in face of minimal perturbation. Attractors are mathematical entities and can be identified accordingly. These concepts may operationalize first and second order changes.

In multistable regimes there are multiple attractors while metastable regimes show only tendencies and relative, as opposed to absolute, coordination tendencies, which are associated with greater flexibility (Kelso, 2012).

Structural coupling

Complex living self-organizing adaptive systems are autonomous and structurally determined (Maturana & Varela, 1992). They are also thermodynamically open, exchanging energy, matter and information with other systems. Through recursive and recurrent interactions two or more systems may couple, becoming structurally congruent and operating as a function of each other. The system may respond to perturbations with change but still conserve its organization (Maturana & Varela, 1992).

Intrinsic dynamics

A system has spontaneous preferred patterns of coordination or intrinsic dynamics (Kelso, 1995). Learning may be a function of the degree of competition and cooperation between intrinsic and new dynamical patterns, varying as a function of specific parametric influences. Learning or change can be reflected not only by changes in the attractors but also system's entire coordination dynamics (Kelso & ËngstrØm, 2006).

Complexity in social and psychological sciences

Complexity has been discussed and applied in diverse ways in social and psychological sciences (Eidelson, 1997) such as cognitive studies (Bressler, & Kelso, 2001), psychotherapy (Tschacher, Scheier, Grawe, 1996) and developmental psychology (Lewis, 2000, 2005; Thelen et al., 1991; van Geert, 2003).

There have been some efforts in regard to the design and application of psychological and relational assessment and representational devices congruent with a dynamical system perspective (Dumas, Lemay, & Dauwalder, 2001; Granic & Lamey, 2002).

Authors such as van Geert and others have aimed at "transforming conceptual models into mathematically formulated dynamic models and (…) run numerical experiments with those models in order to explore their, often hidden or unknown potentialities" (van Geert, 1998, p. 154). Others (e.g. Kelso, 1995) doubt the adequacy of some of these approaches, particularly in their choice of the procedures and equations, critiquing the lack of supporting data but have supported the application of a coordination dynamics search framework to the inspection of human dynamics (Kelso & Ëngstrom, 2006; Thelen et al., 1991).

Complexity in family therapy

Complexity science offers clues to investigate therapeutic family dynamics and a relevant repertoire of methods to describe and analyze them. But the attempts to bring Complexity into family therapy and family therapy research are scarce.

In a 1985 paper, Mony Elkaïm reviewed and used some concepts of Prigogine's theory of dissipative systems to affirm the role of the amplification of singularities in family change. The author applied some concepts to a case illustration at a metaphorical level but little effort was put into building a coherent theoretical framework for addressing and investigating family change processes.

In 1995, Margaret Ward reviewed some of the concepts of Complexity and discussed how they resembled family therapy core tenets.

In 1997, Butz, Chamberlain and McCown explored applications of Complexity to family therapy proposing a revision of core paradigms and assigning to self-organization and nonlinear dynamics a highlighted role as a paradigm for the future. But their metaphorical approach risked being far-fetched and poorly grounded and few guidelines for research were proposed.

For example, the authors compared families to chaotic systems but, despite an intuition that some families appear extremely sensible to minor perturbations one wonders on what ground such comparison made. Chaotic systems are characterized by features such as dependence of initial conditions but they are also deterministic systems, although with a random appearance (Yorke & Sauer, n.d.). Families, as other human systems, are probably more influenced by stochastic processes and intentional dynamics (Longtin, 2010; Kelso & EngstrØm, 2006).

Warren and collaborators (Warren, Franklin, & Streeter, 1998) have reviewed core concepts in Complexity and attempted metaphorical bridges between solution-focused therapies and nonlinear dynamics.

Koopmans (1998) discussed chaos theory and the problem of change in family therapy though providing no justification for choosing chaos as a metaphor for family functioning and provided few clues in regard to how traditional concepts could be reconceptualized from a NonLinear Dynamical Systems (NDS) perspective.

But more than a decade has passed and little research has been performed since these contributions were advanced.

More recently, David Pincus (2009) claimed that psychotherapy processes, being essentially interpersonal, could be understood by a process-focused orientation in light of NDS Theory. He conceptualizes those processes as emerging from the interactions of different individuals and as being regulated by fluxes of information. The author identified common systemic themes (e.g closeness, control, conflict) in psychotherapies considering that “the common theoretical thread (…) is self-organizing flows of information, which helps to provide a deeper explanation of the ongoing questions and unexamined assumptions of psychotherapy process" p. 351. Nonetheless he reviews some of his own and other studies analyzing evidences of self-organization he doesn't point specific ways to empirically investigate such self-organization processes.

Although valuing the contributions here mentioned we think some of them may be at the edge of the dangers against which Varela cautioned us. It may be wise not to import the concepts without carefully investigating their fitness and the limits of their application and usefulness.

The work of Gottman with couples is a paradigmatic good example of the application of the mathematics of complexity. The author and collaborators (Gottman et al., 2002) have used their vast accumulated knowledge about core variables in couples' relationships to explore the nonlinear dynamics of marital relations. They built and tested particular models of the evolution of those relationships under the influence of selected control parameters achieving impressive predictive accuracy.

Process and discovery oriented research: a call for complex grounded theories

Process research is still incipient in family therapy (Friedlander, Wildman, Heatherington, & Skowron, 1994; Sprenkle, Davis, & Lebow, 2009) and much is to be understood about family change and its connection to microtherapeutic processes and their coordination (Heatherington, Friedlander, & Greenberg, 2005). Complexity may inspire us to ask relevant research questions about the complex coordinative nature of therapeutic change and inspect it with a dynamical focus on processes providing the ground for a unifying language, both because of its core comprehensive narrative and its mathematical foundation.

Many questions can be raised for exploration, such as:

(a) What characterizes the relation between different levels of analysis of the family and its ecology in understanding family change (Granic, Dishion, & Hollenstein, 2003)? How do processes and time-scales at each level interact and relate to the therapy's process and outcome? How does individual change relate to family change?

(b) Can features of self-organization be identified during family therapy which can be related to its outcomes? (Tschacher, Scheier, Grawe, 1996; Pincus, 2009) What collective variables best describe the therapeutic system and explain therapeutic outcomes? How can we describe their dynamics in relation to parametric influences?

(c) What kind of couplings between family members and the family and the therapist characterize successful cases and what kind of functional information is implied? What is meaningful information for family change (Kelso & Engstrom, 2006)?

(d) What dynamic patterns and pattern dynamics characterize successful cases? Which variables and what dynamic assessment procedures can be used to inform intervention (van Geert & Lichtwarck-Aschoff, 2005)? What kind of systemic behavior precedes bifurcations? Can we identify characteristics of first and second order changes and operationalize them? What processes relate to stable or unstable changes?

(e) Can we characterize (and what does) critical states in families during therapy? In what ways is family therapeutic change dependent on history and the system's initial conditions? What processes and evidences are implicated in fluctuations and bifurcations?

In our attempts these and other questions we must be reflective on how to borrow the language and resources from Complexity. Specifically, we must be sure to be looking at the most relevant variables at a given level of analysis and, then, to carefully test the applicability and usefulness of Complexity's concepts in addressing key research questions and informing practice.

Our stance is that accumulated knowledge in the study of complex self-organizing systems may heuristically assist researches in conducting discovery-oriented studies (Mahrer, & Boulet, 1999) before advancing into using specific methods and mathematical resources to model family change processes. The field will be limited in its capacity to expand and improve theories of family change if it restrains research to deductive designs. Therefore, space must be open for abduction and discovery (Reichertz, 2007).

Some authors (e.g. Blow, Morrison, Tamaren, Wright, Schaasfsma, & Nadaud, 2009) have explored meaningful factors associated with therapeutic change but more studies are needed.

We believe the field should aim at the development of substantive grounded theories of therapeutic family change process, and, ultimately formal theories of human change (Charmaz, 2006). For that, and in the initial stages of research, we advocate for the use of grounded theory's research methods and techniques (Bryant & Charmaz, 2007) and for using concepts of Complexity as heuristic guides to probe family processes.

Armed with an inquisitive and open attitude towards the new, but without discarding the usefulness of existing theory and multiple forms of accumulated knowledge (Charmaz, 2006), the researcher can create a favorable context for discovery. He is then prone to meet the unexpected and to find himself reconstructing old knowledge through new perspectives. This newness can take the form of completely new information or just new properties or nuances of "old" variables. Inductive reasoning plays an important role in the development of grounded theories but so does abduction, as a powerful tool for the creation of new knowledge. Through the search and analysis of new and unexpected results, the exploration of many possible explanations (Peirce, 1878; Reuchertz, 2007) and their verification (Strauss, 1987), the conditions may be set to deepen the exploration of complex of family processes.

Complexity invites us to identify relevant coordination parameters which best capture the collective behavior of families as complex systems and the nature of therapeutic change as well as control parameters. The researcher must then identify these variables at a given level of analysis and aim to understand their nature, elucidate their dimensions and properties as well as their inter-relationships in regard to therapy outcomes. These variables should represent relevant functional informational. Through grounded theory methods, these variables and processes can be densely and richly described and also abstracted and conceptualized in terms of its dimensions, properties and relations to other variables (Strauss, 1987; Charmaz, 2006).

These theories may become Grounded Theories of Family Complexity if, on the one hand, they are weaved to densely capture the complexity of the family's reality during therapy (Straus, 1987) and, on the other, if the researcher uses Complexity as conceptual guide in the collection, exploration, analysis and interpretation of data. He may use its core concepts as heuristic tools to pose relevant questions when searching for relevant coordination and control parameters and in the exploration of dynamic family patterns and patter dynamics during therapeutic processes (Kelso & EngstrØm, 2006).

Grounded theory methods may bring family therapy researchers closer to Complexity, if, as Kelso proposed, they are used to understand: (1) the boundary conditions and control parameters that define a context for coordinative practices (2) the level of the coordination variables and (3) the level of the individual coordinating elements, their dynamics and relationships (Kelso, 1995; Kelso & EngstrØm, 2006). Thelen and collaborators (Thelen et al., 1991), proposed the following steps for dynamical system research: (1) to identify the collective (coordination) variable; (2) to characterize the behavioral attractors; (3) to describe the trajectory of the collective variable; (4) to identify points of transition; (5) to exploit instabilities at transitions to identify control parameters; (6) to manipulate the control parameters experimentally (therapy may be here included); (7) to explain the phenomena at multiple levels of analysis and aim at their integration.

Building Grounded Theories of Family Complexity, in the first stages of research, may provide the ground for a subsequent application of the mathematical tools of complexity to explore family dynamics. But without preliminary exploratory research we may end up manipulating our theories and forcing them to fit a potentially misconceived perception of family complexity.

Mathematical models can be tested with real and surrogate data allowing for the investigation of predictions connecting therapeutic process and outcomes. Also, relevant control parameters can be manipulated in intervention research studies and intensive case studies. Long data collection sets are often needed to analyze change processes and inspect nonlinear dynamics. Therefore, multiple single-case time series research designs can be a preferred choice of design. At this stage the researcher should continue to look up for new data and variations in order to improve the theories. These repeated cycles of finding and checking hold the promise to deepen our theories and improve our practices (Peirce, 1878; Reuchertz, 2007; Strauss, 1987). Successive cycles of this hybrid, two-stage research process, may assist family therapy in the process of discovering and understanding new aspects of therapeutic family change processes.

Conclusion

Family therapy has long relied on insights from other sciences to develop its body of knowledge and to assist families. But it hasn't kept the pace of the developments in systemic thinking which have occurred under the scope of Complexity sciences.

We hope our reflection stimulates new dialogues between family therapy researchers interested in therapeutic change processes and other scientists. Notwithstanding the need for prudence, we believe it is time to broaden the invitation to family therapists and family therapy process researchers to open and explore new lines of inquiry revisiting old concepts with a refreshed outlook borrowed from Complexity Sciences and, in turn, expand them (Kelso & EngstrØm, 2006). We highlight Grounded Theory methods, under the auspice of abductive/hypothetical thinking in a combination with induction and verification, to assist researchers in the first stages of grasping complex family processes to be followed by a more mathematical approach to theory building and testing. The time has come for the integration of knowledge to reveal the patterns and processes that connect them. In this zeitgeist, we may be compelled to assume the imperfection of our theories but also encouraged to rebuild them with a fresh and more inquisitive outlook to assure we are not blocked by our loyalties and old metaphors nor blinded or mislead by the glow and excitement of Complexity.

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