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On Teaching

Seeking Sustainable Solutions: Using an Attractor Simulation Platform for Teaching Multistakeholder Negotiation in Complex Cases

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We live and work in an increasingly complex and dynamic world. The demands of working in such environments require that negotiators understand situations of conflict and work with these situations in correspondingly complex and dynamic ways. Dynamical systems theory offers important insights and tools to enhance the understanding of difficult social conflicts, including the conceptualization of ongoing destructive conflicts as strong attractors: a particular form of self-organization of multiple elements comprising the mental and social systems associated with conflict. This article describes the pedagogical use of a computer simulation of conflict attractors (the attractor software) that allows participants to visualize and work

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interactively with the dynamics of conflict as they unfold over time. It further describes a negotiation workshop that employs the simulation to enhance participants' understanding of complex long-term dynamics in conflict and presents the findings of two outcome studies comparing the effectiveness of a workshop that employed the simulation with one that employed a traditional integrative problem-solving method. While not definitive, these studies suggest that an understanding of the dynamical approach to conflict, supported by use of the attractor software, can promote the generation of more sustainable solutions for long-term conflicts.

Key words: negotiation, complexity, dynamical systems, attractors, conflict resolution, negotiation pedagogy.

Introduction

We live and work in an increasingly complex and dynamic world. Negotiators today are confronted by progressively more complex ecological, political, economic, and social problems. In addition, the situations they face are in a constant state of flux, changing from moment to moment and over the days, weeks, and months of the negotiation process. The demands of working in such environments require that negotiators understand situations of conflict and work with them in correspondingly complex and dynamic ways. Failure to do so typically results in a misreading of situations and in the generation of unsustainable short-term solutions that can also bring unintended negative consequences (see Dorner 1996; Peterson and Flanders 2002).

Against this backdrop, we present a new pedagogy for teaching negotiations in a complex world. It was first conceptualized as a methodology for attempting to comprehend and address chronic patterns of destructive conflict and violence in New York City public schools. It has since been developed as a platform for teaching multistakeholder negotiations in various situations of protracted social conflict. This methodology is one component of an extensive research project on dynamical systems and conflict, whose developers seek to apply important insights and tools from dynamical systems theory (DST) to enhance understanding of difficult social conflicts (see Coleman et al. 2006, 2007; Coleman 2006; Nowak et al. 2006). This research suggests that it is particularly useful to conceptualize ongoing destructive conflicts as strong *attractors*: a particular form of self-organization of multiple elements comprising the mental and social systems associated with conflict. The centerpiece of the teaching platform presented in this article is a computer simulation of conflict attractors that

allows participants to visualize and work interactively with the dynamics of conflict as they unfold over time.

We first discuss the dynamical systems approach to conflict and the utility of understanding conflict in terms of attractors. We then describe the development of the attractor simulation. This is followed by an outline of a negotiation workshop that employs the simulation. We next present the findings of two outcome studies comparing the effectiveness of a workshop that employed the simulation with one that employed a traditional integrative problem-solving method. Finally, we discuss new directions for the development of this work.

Dynamical Systems, Conflict, and Attractors

Conflict presents a paradox to traditional views of mental process and social relations. By its very nature, conflict is intensely dynamic, with an ever-changing field of forces impinging on the parties involved, evoking a wide variety of mental states and action proclivities that undergo constant change. Because conflicts are associated with phenomenological and behavioral instability, one would expect to observe concerted efforts at conflict resolution that would restore quiescence to people's mental, emotional, and behavioral experience. But conflicts can endure over considerable periods of time without any appreciable diminution of each party's respective mental and behavioral volatility. Indeed, some of the most intense and volatile conflicts are also the most protracted, taking on the semblance of intractability. How is it that a phenomenon so rich in dynamism can lend itself to such impressive continuity?

The apparent paradox of simultaneous volatility and stability can be resolved when conflict is examined in terms of basic principles of complexity theory and dynamical systems. The interplay of dynamism and equilibrium tendencies, in fact, is central to the dynamical perspective on mental and social processes (cf. Nowak and Vallacher 1998; Vallacher and Nowak 2007; Guastello, Koopmans, and Pincus 2008). According to this perspective, any phenomenon can be viewed as a set of interconnected elements that influence one another and that can be made manifest differently, depending on the phenomenon in question. In brain function, for example, influence is indicated by the signaling among neurons, while in social groups, influence is indicated by social interactions among group members.

A coherent state emerges from these mutual influences among elements that, in turn, provide order and stability for the system's elements. Thus, neural interaction might give rise to a meaningful perceptual state and social interaction might give rise to a social norm or belief. Dynamism in this process reflects the mutual adjustment of the states of interacting elements so that they collectively support the coherent state. In a social group, for instance, individuals with initially different opinions attempt to influence each other to adopt a common opinion and thereby promote

group consensus (Nowak, Szamrej, and Latané 1990). When emergence of the system's global state is due to the interactions among the systems' elements rather than to the intervention of outside agents, the process is referred to as *self-organization*.

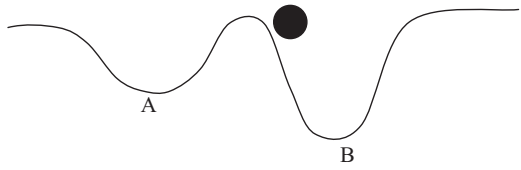
Once a coherent state emerges, it functions as an *attractor* for the system. This means that new input to the system takes on values that are consistent with the values characterizing the elements associated with the attractor. In social judgment, for example, a strongly held view about an outgroup functions as an attractor by assimilating new information about the outgroup to that view. In self-perception, meanwhile, a stable self-concept functions as an attractor by reinterpreting contradictory information received in the course of everyday life. In a sense, an attractor helps the system maintain equilibrium. New input can have divergent interpretations and implications, but over time this diversity will be constrained in line with the interpretation associated with the system's attractor. According to this model, a person may learn information inconsistent with his or her global assessment of an outgroup, for example, but he or she will ultimately reframe this information in a way that supports rather than contradicts the assessment. External influences or noise may perturb the system, but dynamic processes are engaged that return the system to its attractor.

The dynamics associated with the emergence and maintenance of attractors has direct relevance to conflict. In a conflict setting, increases in tension, anxiety, and emotional intensity activate people's desire for coherence that encourages them to make connections among the various thoughts, perceptions, and memories that they associate with the conflict. The conflict progresses toward intractability as these elements self-organize into a structure, such that the elements no longer function independently but rather are linked by reinforcing feedback loops. Each element of the loop increases the activation of the other elements.

Over time, only those ideas and feelings that are consistent with a destructive orientation to conflict are embraced by the parties as relevant and credible. Indeed, the intensity with which parties to a conflict reinterpret or discount inconsistent information or events is a signal of the strength of the attractor characterizing the conflict. Thus, attempts to change the state of conflict without changing the mechanisms that continually reinstate the conflict may result in short-term changes but are likely to be futile in the long run. To promote lasting change, it is necessary to change the attractor states of the system. This is easier said than done because it is tantamount to changing the mechanisms responsible for the system's dynamics.

Figure One illustrates in metaphorical terms the essence of attractors and the relevance of attractors for conflict. Note that there are two valleys and a ball positioned in one of them (B). The ball represents the current

Figure One
A Dynamical System with Two Attractors (A and B)



state of the system. As the figure suggests, it will roll down the hill and come to rest at the bottom of valley B. In stabilizing the state of the system (i.e., the ball), the valley functions as an attractor for the system.

There are two attractors in Figure One and they differ with respect to two basic properties. First, each attractor is associated with a *basin of attraction*, reflecting the set of states that are "attracted" by (i.e., will evolve toward) the attractor. For instance, the mere sight of an outgroup member during a protracted conflict can trigger negative thoughts, feelings, and behavioral responses that combine to propel an individual quickly into their basin of attraction for hostile intergroup relations. Because the basin of attraction for attractor A in Figure One is wider than the basin of attraction for attractor B, a wider range of states (e.g., more peripheral thoughts and feelings) will evolve toward the former. Second, one attractor is depicted as "deeper" than the other, which represents their relative strength. Attractor B is thus stronger than attractor A. This means that it would take a stronger force to dislodge the system from attractor B than from attractor A. Once a system is at attractor B, it is resistant to efforts to dislodge it, even when strong forces perturb the system.

These two attractor properties are relevant to the intractability of conflict. A wider basin of attraction means that a larger range of ideas and action possibilities will eventually evolve toward the predominant mental and behavioral pattern characterizing the parties to the conflict. If the predominant pattern is a negative view of another person or group, positive information that contradicts the predominant negative view is likely to be reframed, reinterpreted, and ultimately transformed by a variety of cognitive mechanisms until it fits the predominant view. By the same token, a peaceful overture or gesture might initially be taken at face value, but over time it will be reframed until it provides evidence in support of, rather than in opposition to, the predominant response tendency of the person or group.

The depth of an attractor indicates how difficult it could be to transform the malignant tendencies of an intractable conflict. When the attractor

for destructive conflict is deep (as in attractor B), attempting to resolve the conflict is like trying to push a ball uphill from the valley floor. When the pushing force is relaxed, the ball will reverse its trajectory and roll back to the attractor (the bottom of the valley). So, for example, pointing out the nonproductive nature of a person's hostility toward someone else may achieve a few temporary concessions — in effect, pushing the ball up the side of the valley — but eventually, this appeal to logic will fail as the forces restoring the attitude overwhelm the persuasive appeal — much like gravity eventually proves too much for muscle power.

Note, however, that if a force is sufficient to dislodge the system from its attractor (e.g., A), the system will gravitate in short order to another attractor (e.g., B), if one is available. This implies that if a system is characterized by more than one attractor, the mental, affective, and behavioral states characterizing the system tend to sort themselves categorically. If a change in the system's state occurs, it is likely to do so in a qualitative (nonlinear) rather than incremental (linear) fashion (cf. Latané and Nowak 1994).

In the dynamical model of conflict, in sum, the *organization* of elements rather than the specific nature of those elements causes intractability. Multiple elements become linked through reinforcing feedback loops to establish an equilibrium that pulls the respective parties into a state of conflict, which makes conflict resolution an even more daunting task. Establishing trust between mutually antagonistic groups, for example, is certainly a noble goal and may be a necessary step in the resolution of intergroup conflict. In light of the dynamical scenario, however, this step may prove unsuccessful. Even if trust is somehow established between the groups, other linked thoughts, memories, and expectations will disrupt the trust and reinstate the conflict. With this in mind, successful intervention should not try to push the person or group out of its equilibrium but rather try to change the social system in such a way that the equilibrium among forces changes. This involves disassembling the malignant attractor and working to establish an alternative attractor (or bolster an existing alternative attractor) for more benign or positive relations, and *then* moving the system into the basin of the new attractor (provided one can be established).

The Attractor Simulation

From the dynamical systems perspective, enduring conflicts can be viewed as attractors within a given social system. If the attractor for destructive conflict is strong (wide and deep), then the system will tend to be pulled toward a state of conflict and to return to this state when disturbed by outside influences. However, a full understanding of conflict dynamics in terms of attractor changes requires more than a description of the current attractor for destructive conflict. The strength of the alternative attractor for

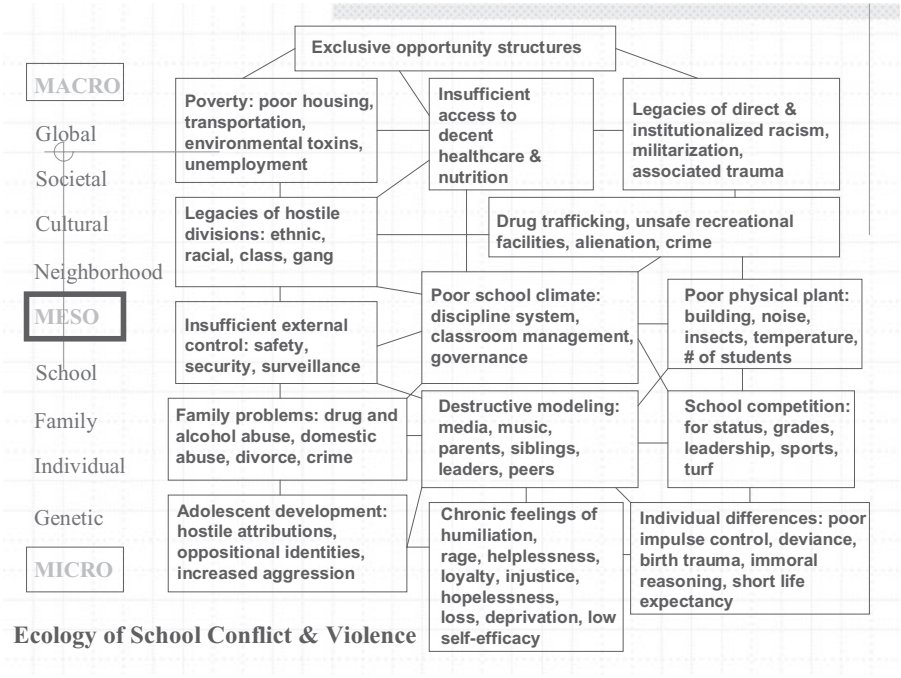
peace and positive social interactions is also critical — especially for conflict transformation strategies. A conflict system's dynamics can be caught and controlled by a destructive attractor, in which case the attractor's tendencies can be seen in that conflict's particular processes (such as overt hostilities and violence). An attractor can also remain dormant, however, and possibly capture the state of the system in the future. In sum, then, a conflict system can be characterized on three dimensions: its current (manifest) state, its potential to generate positive interactions, and its potential to generate negative interactions.

Characterizing conflict on these three dimensions presents challenges to those unfamiliar with a dynamical systems approach and, specifically, with the concept of attractors. Moreover, any factor influencing a social system characterized by conflict may affect each of the three dimensions in different ways, which makes systematic analyses of relationships between a conflict system's elements almost impossible. For example, an increased police presence in an intergroup community conflict may decrease the momentary state of violence in the community, but it may also decrease the strength of the attractor for future positive interactions between the parties and, at the same time, increase the strength of the attractor for future negative interactions. Thus, understanding the multiple consequences of an action can be difficult for any person involved in a dynamic conflict situation.

The development of the attractor simulation was inspired by our experiences working with teachers, students, administrators, and volunteers in urban schools with histories of chronic conflict and violence. We typically began these initiatives by interviewing stakeholders in these schools to generate a sense of the "essence of the problems" they faced. These interviews typically elicited a cataloging of a multitude of complex interrelated problems and processes (see Figure Two) that left the stakeholders and our team feeling generally overwhelmed and depressed. This complexity presented extraordinary challenges to any clear analysis of these conflict situations, let alone the development of plausible scenarios for successful intervention. Almost every possible intervention targeted one factor or another in the conflict, but also appeared to either impede or fail to address other issues or simply could not be undertaken given the conditions of the system as a whole.

Feeling challenged by the cases described by the stakeholders, we decided to work toward the development of a software platform that could help them unravel the complexity inherent in these systems of progressively more complex conflicts. Our main goal in developing the attractor software was to help conflict stakeholders, negotiators, and third parties understand and systematically map the complexity of various factors influencing a given conflict system in order to better visualize possible intervention strategies and consider the multiple consequences and potential impact of their actions. (An overview and tutorial on the attractor software platform is available at http://www.attractorsoftware.iccc.edu.pl.)

Figure Two
The Ecology of Urban School Conflict and Violence

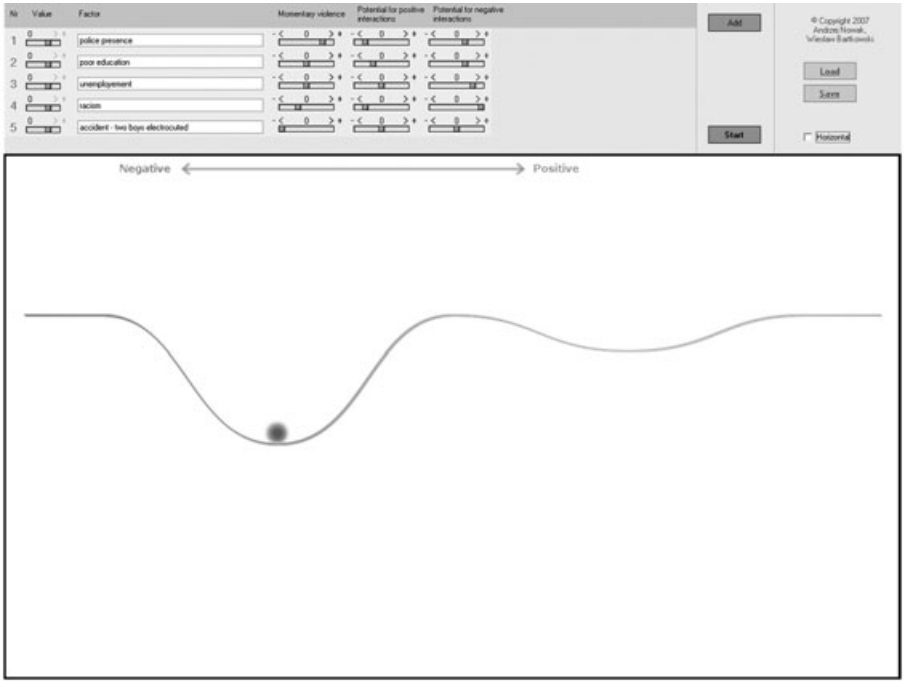


The attractor software is essentially a visualization tool. It prompts the user to specify the key factors influencing the conflict and the actions that can be undertaken, and to estimate the consequences of these actions with respect to three types of outcomes:

1. their influence on the current state of the conflict;
2. their influence on the potential for future conflict or negative interactions; and
3. their influence on the potential for positive social interactions and, ultimately, sustainable peace.

The user, by evaluating each factor, estimates the strength and the direction of the influence of each factor on the whole system. The software merely visualizes the understanding of the user, as a tool for encompassing and systematically describing what parties and interveners have identified, based on the user's own expertise and experience with a case. The

Figure Three
Input and Output

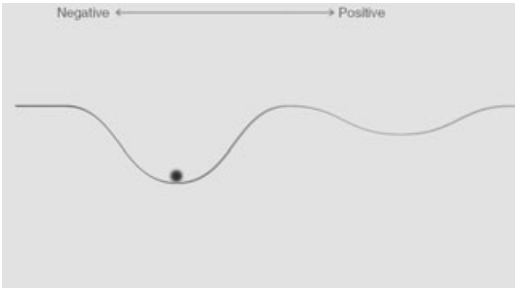


software does not estimate the importance of each factor by itself nor its influences. It is up to the user to:

1. specify the case and the social relations to be analyzed (e.g., a marriage, an ethnic conflict);
2. generate the list of factors that are likely to influence the nature of the current and future relationship[1]; and
3. evaluate the importance and strength of each factor for the system, and the direction of its influence along the three dimensions considered. (See Figure Three; the list of input factors is followed by an illustration of the attractor landscape and the momentary state represented by the moving ball toward the valley.)

The program provides a visual depiction of two possible attractors for the relationship: a positive attractor indicating stabilization of benign or favorable attitudes and positive actions, and a negative attractor indicating

Figure Four
A Conflict Attractor Landscape with Two Attractors



Destructive interactions are on the left and constructive interactions are on the right.

stabilization of malignant or unfavorable attitudes and negative or violent actions. (The software begins with no attractors but has the potential to reveal two. See Figure Four.) How the factors introduced by the user affect the overt thoughts and behaviors in the relationship will thus depend on the respective strength and depth of the positive and negative attractors. If the current state of the relationship (e.g., good versus bad feelings) is within the basin of a strong attractor, then this state is unlikely to change despite the introduction of factors relevant to change. Conversely, if the current state of the relationship is outside the basin of the attractor, then the relationship may display a qualitative change (e.g., from positive to negative) with the addition of a single, seemingly unimportant factor.

Using the Program

The program relies on the user's experience with the conflict or expertise in a particular area. Specifically, it assumes that the user is somewhat knowledgeable about the factors relevant to the thoughts, feelings, and behaviors that characterize the analyzed relationship and that he or she can specify *his or her sense of* the relative importance of these factors. Someone who works with high school gangs, for example, may be in a position to identify the various events that affect each gang's feelings, thoughts, and behaviors. Such analyses, however, gain considerable depth and validity if they directly involve various members of the concerned groups. The users then type in the label for a factor and use a slider bar to specify its overall importance in affecting the relationships within the system.

Despite the user's expertise and insight, the influence of specific factors introduced into the visualization software is not obvious. As noted

earlier, a minor provocation can push two groups into open warfare, while a major change in conditions might have little effect at all on relations between the two groups. Attractor dynamics help explain such nonlinearity between influencing factors and the observable state of the relationship. This can be illustrated when the attractors characterizing the relationship are described and the resulting dynamics can then be visualized by the user. This is because a momentary change in thought or behavior in response to a specific factor does not necessarily affect the long-term features of the relationship. However, the strong potentials of these systems (latent attractors) sometimes become manifest as qualitative shifts in the relationship (e.g., radical shifts transform peaceful relations to conflict or violence to peace). If the state of a person or group is currently controlled by an attractor, then even strong forces that seem capable of changing thought and behavior may be countered by the attracting tendency of the prevailing thoughts and behaviors. But if a person or group's state is currently outside the basin of one attractor, then even a minor force might be sufficient to move the person or group's thoughts and actions toward a completely different attractor.

In addition to using his or her knowledge and insight to specify relevant factors and their respective importance, the program's user may also specify the nature of their impact. Sometimes a factor can have both a positive and negative impact. In a marital relationship, for example, raising children can strengthen the bonds between the partners, but it can also produce considerable stress and thus challenge the relationship. To capture a factor's potential for both positive and negative effects, the user employs separate slider bars to indicate how much the factor in question promotes positive thoughts and behaviors, and how much the factor promotes negative thoughts and behaviors in the relationship.

We note that these two characteristics of relationships do not always act in opposition; in fact, they often prove to be orthogonal. This means that the potential for positive interactions can grow or decrease somewhat independently from the potential for negative interactions. For example, fostering social contact between conflicted groups can increase the potential for both positive and negative interactions. The program also allows the user to specify, on a slider bar, the degree to which the factor in question contributes to eruptions of violence. Again, the user's expertise and insights are critical here. In ethnic relations, for example, income disparity may be an important factor in the long run, but it is unlikely to directly spark an episode of violence on a particular day. An act of humiliation, in contrast, may well catalyze momentary violence in such a relationship. A separate slider bar allows the user to specify the impact of each factor on the immediate versus long-term reactions of the system.

Finally, the program allows the user to reconfigure the attractor landscape directly. The preset configuration of positive and negative attractors may not

fully capture the user's knowledge and insight. It may be, for example, that the user thinks that the positive attractor is relatively weak (i.e., a shallow valley) but has a wide basin of attraction (i.e., a wide valley), whereas the negative attractor is quite strong but has a narrow basin of attraction (i.e., a deep but narrow valley). By changing the attractor landscape, the user can observe whether the relevant factors and their specific effects (i.e., on positivity, negativity, and momentary violence) begin to play a larger or smaller role in defining the overall quality of the relationship. The software can thus be employed in different ways to achieve different ends.

Potential Applications

The attractor software can be applied in different settings and can be useful in different ways. The program's benefits include managing complexity, untangling the long-term and short-term consequences of conditions and actions, and understanding that the same action can have conflicting effects on the positive and negative aspects of the interaction. In more general terms, the software enables users to directly experience dynamical concepts and tools, and thus fosters their ability to understand conflicts. Below, we outline some of the software's possible uses and benefits:

1. The interactive nature of the program enables students, negotiators, and third parties to tap their knowledge of and insights about conflict and to see how these factors affect both the momentary and long-term state of the relationship among the conflicting parties. With the addition of each new factor, the state of the relationship at that moment is changed, but whether this change affects the long-term relationship will depend on the attractor landscape. This should sensitize users to the distinction between interventions that have immediate but not long-lasting effects and interventions whose effects may not be immediately apparent but that change the attractor landscape and create new possibilities for relationships.

2. Social science theory and data can be used to identify relevant factors in particular situations, to specify the overall importance of these factors, and to define the impact of these factors on positivity, negativity, and momentary violence. In this way, the program can be used both to test the assumptions of existing social science data and to identify which factors should receive attention in real-world contexts. Conversely, if the role of these factors has been unequivocally established in research and real-world contexts, one can modify the attractor landscape to make the results of the program come into line with such findings. This "reverse engineering" would help researchers and practitioners identify the manifest and dormant attractors in interpersonal and intergroup relations. The identification of inactive attractors is particularly important because they represent possible relationship states that might otherwise go

unrecognized by the parties involved but that could provide a focus of intervention.

3. Users can work with the software in small groups, which allows them to share insights and together identify relevant factors, specify the effects of these factors, and observe how the relationship responds in both the short term and the long term. Rather than arguing about the likely effects of different interventions, for example, the users can test their respective assumptions and intuitions, and in this way, possibly reach a common understanding with agreed-upon strategies for conflict resolution.

4. The software can also be used as a platform for resolving conflicts among representatives of conflicting parties. The parties to a conflict often see the world in different terms, and this lack of a shared reality can contribute to a conflict's intractability. By working with this software in a collaborative venture, the representatives of the conflicting parties can discover what factors are most relevant to the maintenance of the conflict. More importantly, an initiative of this kind could promote an agreed-upon mode of intervention for resolving the conflict.

A Workshop on Negotiation and the Dynamics of Complex Conflicts

We have conducted a series of workshops[2] aimed at presenting the relevance of DST to complexity and change in conflicts and negotiations, and have devoted portions of these training sessions to exercises using the attractor software. Our purpose was, first, to integrate and solidify participants' understanding of conflict dynamics from a DST perspective and, second, to provide practical experience in using this theory to deal with real cases of complex conflicts. These workshops included a preparatory tutorial designed to introduce the notions of dynamical systems, attractors, and conflict dynamics to the audience.

Below, we present the exercises developed specifically for use with the attractor software. We note, however, that they constitute an integral part of a whole pedagogy introducing the DST approach to conflict dynamics. First, instructors introduce the visual interface of the software, describing explicit links to the theory and to the specific properties of attractors in conflict. Next, participants take part in a warm-up exercise designed to familiarize them with the software and its various options, and to translate into dynamical terms participants' understanding of a given conflict case using the options and visualization strategies offered by the software interface. Instructors have used the recurring youth riots in France in 2005, 2006, and 2007 (based on press reports, short films, and pictures) as an illustration of a case to be analyzed through the attractor software tool.

Initially, the group is divided into small subgroups of approximately five members each. Each group discusses and lists factors that they feel might be relevant to the case. Next, each group estimates how these factors may influence three aspects of the conflict, through the evaluation of their potential for positive interactions (strengths of positive attractor), their potential for negative interactions (the negative attractor), and the current state of violence. Subsequently, instructors display the user interface on a computer screen and multimedia projector, demonstrating how to input all the factors generated in the group into the software. As the software output is explained, the three types of effects of each factor are depicted on the screen. Participants discuss each factor's possible effects on the system's dynamics and how each attractor and momentary state could change after new factors are introduced. Specific practical issues related to the software are then addressed as well as participants' technical questions.

After the introductory session, instructors again divide participants into five-person or six-person subgroups. Each group receives a generic description of a complex conflict case, in which the short-term and the long-term consequences of different factors and actions may go in the opposite directions (i.e., factors having good consequences in the short run have bad consequences in the long run and vice versa). The scenario employed in our basic workshop concerns an environmental conflict around Riverbank State Park in West Harlem, New York, which was constructed above a sewage treatment plant in New York City (Holloway 1992). A short-term, integrative solution that seemed to satisfy both the city administration and community advocates was to build the sewage treatment plant and to compensate the community by constructing a park on the roof of the sewage treatment plant that could be used by the community. This park (28 acres) included a football field, softball diamonds, basketball courts, indoor and outdoor swimming pools, picnic areas, and restaurants. Although the solution seemed integrative and satisfying in the short term, it raised several questions, such as whether it was healthy and safe for children to play on the roof top of a building that processes 170 million gallons of raw sewage a day, what to do about odors from the plant, and why the city chose to place the plant in a poor minority neighborhood (Harlem) instead of the wealthier, whiter Upper West Side area, where it was initially planned.

Later on in the workshop, we ask the groups to process complex conflicts from their own experience as conflict resolution practitioners, as stakeholders, or as observers. The groups work together using the software for approximately half an hour. During this time, they list the factors affecting the conflict and observe the positive, negative, and long-term and short-term consequences as different factors are introduced.

In the next phase, participants move from describing the *status quo* of the case to generating possible transformation scenarios, introducing

hypothetical factors that can potentially change the course of the situation. Participants are encouraged to work on the whole system and to try strategies designed to:

1. minimize the negative attractor;
2. maximize the positive attractor; and
3. move the current state from the negative toward the positive attractor.

Through this process, participants assimilate complex features of DST and apply them directly to practical problems. We have found the intervention scenarios generated during this phase of the project to be remarkably mature because they consider both the short-term and long-term consequences of the proposed changes. Participants consider their own potential impact on social relations with regard to conflict resolution strategies and to the creation of conditions for sustainable, active positive relations. Two important indicators of a solution's effectiveness are the presence of dormant but potentially significant problems and the degree to which the solution allows for the stabilization on the positive attractor (active, positive social relations) in the future.

The final phase of the exercise is dedicated to group discussion. Participants discuss in a large-group forum the cases analyzed, the factors they have considered, the possible solutions they generated, and the effectiveness of these solutions as indicated by the attractor software. They also discuss their experiences with the software, including both their discoveries and their difficulties. This phase of the project is particularly relevant for groups in which different perspectives on the same problem have been confronted. Thus, participants can compare and contrast their results with the outcomes of different attractor software simulations on the same problem. We provide participants with tools that allow for a debate around concrete factors, including long-term versus short-term interests and potential changes resulting from proposed solutions. The tools also facilitate discussion of participants' different worldviews, as represented by complex systems of interconnected elements. Beyond enabling the sharing of different perspectives, the visualization of a concrete problem enables users to systematically consider each solution.

Comparing Two Models of Negotiation Training

We conducted two studies investigating the effects of the attractor software training on the sustainability of agreements generated by participants in two negotiation courses at the University of Warsaw in Poland. Participants in both courses were trained in both integrative negotiation and conflict attractor dynamics. Participants worked on a negotiation case concerning a union postal strike against a governmental postal system. Each class was divided into two subgroups, with one subgroup learning to negotiate with

the help of the attractor software and the integrative negotiation model, and the other subgroup trained only in integrative negotiation (although the attractor software training was subsequently provided to the second group for educational purposes). Thus, we were able to compare the results of the negotiations achieved with or without the help of the attractor software training.

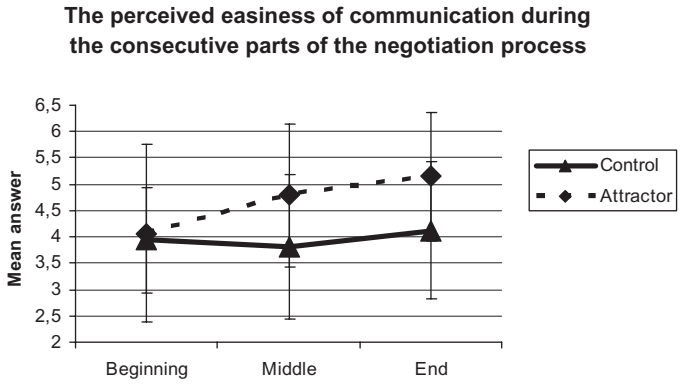
During the first day of training, participants received instruction in the conceptual foundations, strategies, and tactics of integrative bargaining. The theoretical discussion sessions were intertwined with negotiation games, during which participants could apply and practice the acquired knowledge. We began with some of the basic principles of integrative bargaining as articulated by Roger Fisher, William Ury, and Bruce Patton (1991) (separate the people and issues; focus on interests, not positions; generate options; use objective criteria), and next focused on tools and techniques for bargaining with difficult counterparts (Ury 1991).

On the second day, we started the experimental procedure. First, we randomly divided the thirty students (twenty-five female and five male) into two equal subgroups, and then separated the groups so that they had no further contact with each other. The first group negotiated the postal strike conflict in dyads, while the second group (at the same time) received instruction in the dynamical approach to conflict and the attractor software. The latter group worked on the Riverbank Park conflict during the attractor training. Then, they were divided into dyads and were instructed to negotiate the postal strike conflict. At this time, the first group started their instruction in the dynamical approach to conflict. At the end of these sessions, we brought the two groups together again and discussed the negotiations, their experiences of the dynamical approach, and the attractor software. Then, the participants were debriefed and thanked for their time.

The negotiated case concerned a conflict between a postal labor union and the management of the postal service in an imaginary country called "Ubu." Participants received private scenarios that described the conflict situation from the point of view of either the union or the management. Under this scenario, the postal service is state owned, but new delivery companies have emerged and have started to take over both the clients and employees of the postal service. In response, the postal union organizes and conducts a general strike. They demand a pay raise, additional income for marketing efforts, improvement of their conditions, and payment of unpaid overtime, among other demands. The postal service, however, must increase its competitiveness in order to avoid losing its market share. The goal for all participants is to negotiate the conditions for ending the strike.

After completing the negotiations, participants were instructed to fill out a Likert-type questionnaire rating their perceptions (1 = very bad, 6 = very good) of the software usefulness (the attractor group only), satisfaction with the process and the outcome of the negotiation, the level of

Figure Five
Relative Ease of Communication during Three Phases of the Negotiation Process



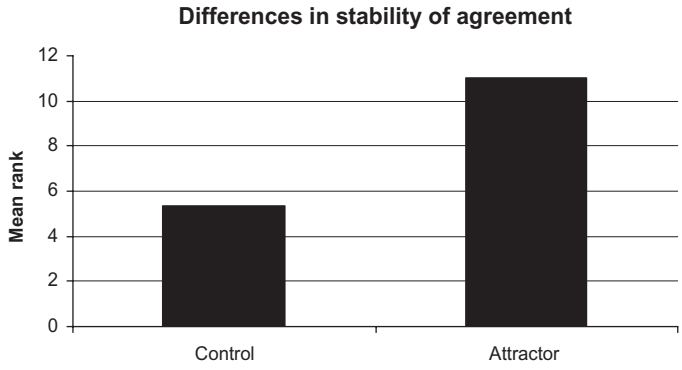
power of both participants in the negotiation, and their perceptions of the durability of their negotiated agreement. In addition, they provided information about their gender, age, major field of study, and the nature of the contract signed in the negotiation.

The results supported the utility of the additional training with the attractor software. Participants who employed the attractor software found it much easier to communicate with their negotiation partners. The *U* Mann–Whitney test for significance revealed marginally significant differences between groups according to mid-negotiation ease of communication with a negotiation partner[3] and significant differences during the final phase of the negotiation process.[4] The data are presented in Figure Five.

The participants in the attractor software group also reported a better understanding of the negotiation process than did participants in the control group.[5] We found no significant differences in understanding at the early phase of the negotiation process.[6] Participants in the attractor condition reported better understanding of the process in the middle phase[7] and the final phase[8] of the negotiation, however.

The findings related to differences in the outcomes of the negotiations between the two groups were the most interesting (see Figure Six). Our analyses revealed no significant differences between the groups in their experiences of satisfaction with the outcomes,[9] satisfaction with the negotiation process,[10] or perceptions of fairness of the outcomes.[11] We also found no significant differences between the groups in the number of positive solutions generated for the postal union,[12] nor were there

Figure Six
The Differences between Groups According to the Stability of Reached Agreements



significant differences between groups in the number of positive solutions generated for postal management.[13]

Analyses of variance, however, revealed statistically significant differences between the groups in the long-term stability of the agreement.[14] We assessed this by calculating the overall costs of the agreements achieved and comparing these to the feasibility of managing these costs and their adverse impact on the financial viability and stability of the postal company. Similarly, *t*-tests revealed significant differences between these groups[15] on these same criteria. According to these criteria, each pair that negotiated with help of the attractor software achieved durable long-term solutions, whereas the majority of the other pairs failed to achieve such results (five out of eight).

Taken together, the results reveal an interesting schism between the participants' perceptions of the outcomes of the negotiations and the bottom-line implications of their agreements. These implications are directly relevant to the sustainability of the solutions generated for conflicts. Although these studies did not control for the effects of simply having more training (integrative negotiation plus the attractor training) on the outcomes, the results do suggest that the use of the attractor software in the negotiation promotes the attainment of better results. Future research should control for this alternative explanation. These findings also speak to the fact that even a highly satisfying outcome may be not be durable, and that this fact may go unnoticed to the parties until the consequences of their actions come back to haunt them. The attractor software, in sum, can serve as a nontrivial but simple tool that potentially increases the durability of agreements.

Conclusion

Although the dynamical systems approach to conflict analysis, research, intervention, and training is at an early stage of development, it nonetheless holds great promise for conceptualizing, comprehending, and working with conflict dynamics in all types of social relations. The attractor software tool and negotiation training pedagogy described in this article is just one of the many practical initiatives that we believe will emerge from working with these new theories and technologies. Our experiences thus far with the attractor software have been uniformly positive, but we must stress again that we have observed that use of the software delivers its best results when it follows a careful introduction to the dynamical perspective on conflict. Clearly, the attractor software is not a self-contained tool but rather represents an important component of the dynamical approach.

NOTES

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1. In thinking about a marital relationship, for example, the user might consider finances, children, and sex to be critical factors in determining how the martial partners will relate to one another, whereas in thinking about ethnic conflict, they may feel that such factors as discrepancies in wealth, religiosity, and the history between the groups are the critical factors dictating how the groups feel about and act toward one another.

2. These included a series of workshops on violence in New York City schools (held at Columbia University in 2005), portions of a Columbia University course entitled "Conflict and Complexity" (2006 and 2008), a presentation at the International Association for Conflict Management (IACM) annual conference in Montreal (July 2006), a presentation at a conference in Kazimierz Dolny, Poland, entitled "Dynamics and Complexity of Intractable Conflict" (October 2006), a workshop at West Point Military Academy (2007), and courses at the Warsaw School for Social Psychology (2006, 2007, and 2008).

3. $U = 66.5, p < 0.053$.

4. $U = 60.5, p < 0.05$.

5. $U = 54, p < 0.05$.

6. $U = 90, p < .34$.

7. $U = 51, p < 0.01$.

8. $U = 48.5, p < 0.01$.

9. $U = 90.5, p < .35$.

10. $U = 86.5, p < .26$.

11. $U = 74, p < .11$.

12. $t = 1.62, 20, 4, p < .12$.

13. $t = 1.33, 28, p < .19$.

14. $F = 5.92, 1, 30, p < 0.05$.

15. $t = 3.18, 10, 1, p < 0.01$.

REFERENCES

Coleman, P. T. 2006. Conflict, complexity, and change: A meta-framework for addressing protracted, intractable conflicts — III. *Peace and Conflict: Journal of Peace Psychology* 12: 325–348.

Coleman, P. T., L. Bui-Wrzosinska, R. Vallacher, and A. Nowak. 2006. Approaching protracted conflicts as dynamical systems: Guidelines and methods for intervention. In *The negotiator's fieldbook*, edited by A. Schneider and C. Honeyman. Chicago, IL: American Bar Association Books.

Coleman, P. T., R. Vallacher, A. Nowak, and L. Bui-Wrzosinska. 2007. Intractable conflict as an attractor: Presenting a dynamical model of conflict, escalation, and intractability. *American Behavioral Scientist* 50: 1454–1475.

Dorner, D. 1996. *The logic of failure: Why things go wrong and what we can do to make them right*. New York: Holt and Company.

Fisher, R., W. Ury, and B. Patton. 1991. *Getting to yes: Negotiating an agreement without giving in*. New York: Houghton Mifflin Books.

Guastello, S., M. Koopmans, and D. Pincus (eds). 2008. *Chaos and complexity in psychology: The theory of nonlinear dynamical systems*. Cambridge, UK: Cambridge University Press.

Holloway, L. 1992. 28 acres of roof and a place to play in West Harlem; Riverbank State Park is under construction atop north river sewage treatment plant. *New York Times* September 1: 1.

Latané, B. and A. Nowak. 1994. Attitudes as catastrophes: From dimensions to categories with increasing involvement. In *Dynamical systems in social psychology*, edited by R. R. Vallacher and A. Nowak. San Diego, CA: Academic Press.

Nowak, A., J. Szamrej, and B. Latané. 1990. From private attitude to public opinion: A dynamic theory of social impact. *Psychological Review* 97: 362–376.

Nowak, A. and R. R. Vallacher. 1998. *Dynamical social psychology*. New York: Guilford Press.

Nowak, A., R. Vallacher, L. Bui-Wrzosinska, and P. T. Coleman. 2006. Attracted to conflict: A dynamical perspective on malignant social relations. In *Understanding social change: Political psychology in Poland*, edited by A. Golec and K. Skarzynska. Haauppague, NY: Nova Science Publishers Ltd.

Peterson, J. B. F. and J. L. Flanders. 2002. Complexity management theory: Motivation for ideological rigidity and social conflict. *Cortex* 38: 429–458.

Ury, W. 1991. *Getting past no*. New York: Bantam Books.

Vallacher, R. R. and A. Nowak. 2007. Dynamical social psychology: Finding order in the flow of human experience. In *Social psychology: Handbook of basic principles*, 2nd edn, edited by A. W. Kruglanski and E. T. Higgins. New York: Guilford Publications.