

Perceptual and Societal Dynamical Models for Compliance and Peace Building

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“Intuition and experience are necessary for revolutionary leadership, just as for all other kinds of creative activity. But much more than that is needed ... You must have a synthetic doctrine comprehending the interactions of the chief historic forces. Here you must have a materialistic method permitting you to discover behind the moving shadows of program and slogan, the actual movement of social bodies.”

Leon Trotsky, 1932, 1961: *The History of the Russian Revolution*.

INTRODUCTION

The seventh Cornwallis workshop discussed the use of analytic processes to support compliance and peace building-related activities. This paper presents some work by the author undertaken in the early 1980s (Woodcock, 1987) that developed models of the events

of the Russian Revolutions of 1917 based on Trotsky's description of those events (1961). It is presented here to demonstrate how it is possible to generate an understanding of the internal representations of the external world created in the minds of both friend and foe in terms of the ways that such individuals describe and react to external events. Development of such an understanding is important when faced with the need to undertake the tasks associated with achieving compliance and building peace in a complex societal environment.

This earlier work led to the definition of a process called *Neuro-Archeology* by Woodcock in which the artifacts of the activities of the human brain are discovered in the writing or other activities produced by the individual concerned (Figure 1). Those artifacts are then used in an attempt to reconstruct the nature of the internal dynamics, representations, and models that may have been responsible for their creation. The mathematical framework provided by catastrophe theory is used as the basis of the Neuro-Archeological modeling process. The paper will demonstrate how Trotsky's descriptions of the political process of revolution can be illustrated with diagrams and models provided by the theory. It is believed that Neuro-Archeological modeling provides at least a plausible representation of some aspects of the internal models created by Trotsky during his extensive involvement in the political processes in Russia. It is suggested that use of such techniques in other areas might provide some insights that may facilitate the processes of compliance and peace building.

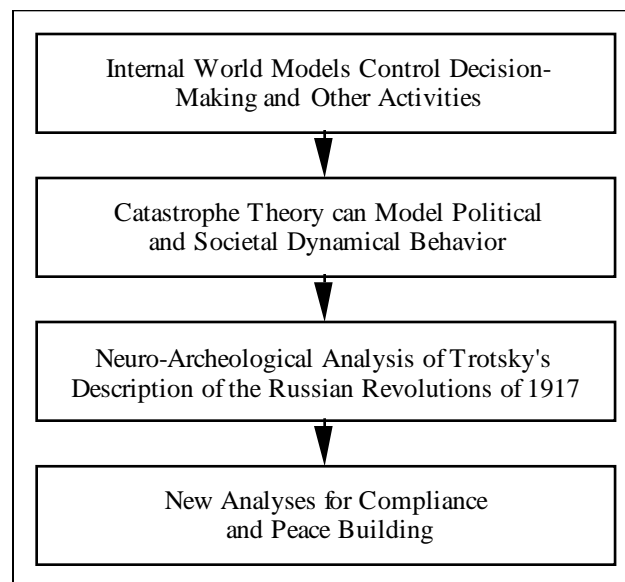


Figure 1: New analytic methods to support compliance and peace building can build on earlier research that used catastrophe theory in a Neuro-Archeological study of Trotsky's descriptions of the Russian revolutions of 1917.

INTERNAL WORLD MODELS CONTROL DECISION-MAKING AND OTHER ACTIVITIES

Internal representations or models of the external world created in the human brain appear to play major roles in determining the actions taken by individuals in response to new and emerging situations. Experience and perceptions of vulnerability and risk can determine the nature and magnitude of such actions. In some cases at least, what appears to be highly

threatening to one individual may present a low threat to others (Woodcock, Cobb, and Langendorf, 1993, for example). Compliance is the process of agreeing or yielding to a demand. It can involve defining a set of conditions or criteria that need to be met in order to permit further actions to be undertaken and some form of monitoring in order to determine whether or those conditions or criteria have been satisfied. The perception of the external world may vary from individual to individual and such differences or ambiguities in perception can influence all aspects of the compliance process (Figure 2).

Compliance can play an important role in developing the understanding and trust needed to support the complex and challenging processes involved in peace building. The ability to identify at least some aspects of the internal representations of the external world created by individuals involved in compliance and peace building activities might facilitate the overall process. In earlier work, Woodcock showed that the words used by Trotsky to describe the processes of revolutionary political change and the formalism provided by catastrophe theory could be used to create geometrical, landscape-like, representations whose properties reflect the verbal descriptions of political events in Russia in 1917. What has that to do with peace building and compliance? Human decision-making and related actions appear to reflect the nature of the internal world models created by the nervous system in response to sensory inputs and the internal processing of those inputs. A better understanding of their nature may assist the complex tasks associated with compliance and peace building.

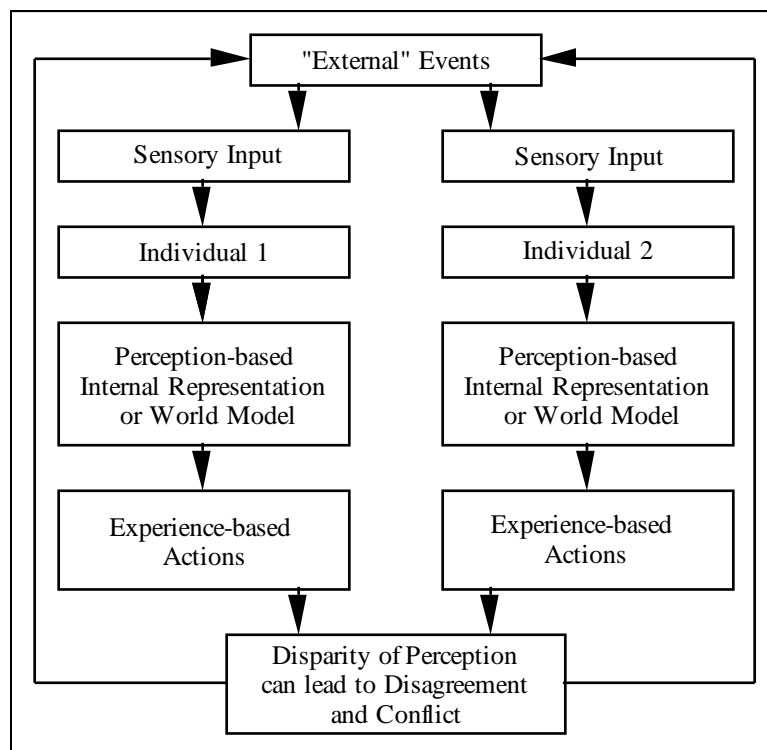


Figure 2: Disparity of perception can lead to disagreement and conflict. The reconciliation of disagreement and reduction of conflict play may important roles in compliance assessments and peace building activities.

Different human experiences can lead to the creation of different perceptions of reality and to the creation and modification of different internal representations or models of the external world (Figure 2). Those experiences and the internal representations that they create can affect the way that each individual responds to new experiences and changing

circumstances. It is believed that development of at least a partial understanding of the ways that individuals perceive and react to external events can be of significant benefit in assessing the perception of compliance and the success of tasks associated with peace building.

CATASTROPHE THEORY CAN MODEL POLITICAL AND SOCIETAL DYNAMICAL BEHAVIOR

We begin the process of model-building with a brief introduction to some aspects of catastrophe theory and will then use that information to show how the theory can provide a basis for modeling the political process associated with complex societal dynamical activities. This will be followed by use of the formalism provided by the theory to illustrate and model Trotsky's descriptions of the Russian revolutions of 1917. There are seven elementary landscapes (or, technically, manifolds) and they are particularly useful for modeling situations where gradually changing forces can produce either gradual or sudden changes in behavior in the same system under different conditions (Woodcock and Poston, 1974, for example). Applications of catastrophe theory can involve construction of the simplest possible model (that is a model that uses as few control factors and behavior variables) that captures the essence of overall system behavior. Once the number of factors at work in a particular system has been identified, the theory provides an indication of which landscape is appropriate for expressing the causal relationships between these factors.

Catastrophe theory-based landscapes represent the complete ensemble of all stationary state conditions a particular system drawn on a series of axes representing the key influences at work in that system (Thom, 1972; Zeeman, 1978a; and Poston and Stewart, 1978, for example). In some cases it is appropriate to construct probability distributions that describe the likelihood that a system would exhibit a particular type of behavior. The catastrophes have names that reflect the shape of their associated catastrophe landscapes. The fold catastrophe has one, the cusp two, the swallowtail three, and the butterfly four control dimensions (or control factors), respectively (Figure 3). Each of these catastrophes has a single behavior dimension so that the fold, cusp, swallowtail, and butterfly catastrophes are essentially two, three, four, and five dimensional objects, respectively. An additional group of elementary catastrophes called umbilics (with two behavior dimensions and either three or four control dimensions) could be used as the basis of more complex societal models.

The elementary catastrophes provide models of systems that act to minimize some form of potential function or to maximize some form of associated probability distribution. The cusp and butterfly catastrophes (with two and four control dimensions or factors, respectively) will be used in the development of Neuro-Archeological models. The nature of their potential functions and probability distributions are outlined below. The potential function associated with the cusp catastrophe (V_C) is presented in equation (1) and its associated probability distribution (P_C) is shown in equation (2). In these equations, (x) represents the *behavior dimension* and (a) and (b) the *control factors*. The coefficient (k) is a *normalizing coefficient* that is used to insure that the total area of the probability curve is unity (100 per cent overall probability). The control factors (a) and (b) define an entity called the *control space*. Positions on that space are determined by particular values of the control factors (in a similar way in which latitude and longitude define position on a geographical map) represent the nature and magnitude of the influences acting on the system modeled by the cusp catastrophe, for example.

Catastrophe Name	Number of Dimensions		
	Control	Behavior	Overall
Fold	1	1	2
Cusp	2	1	3
Swallowtail	3	1	4
Butterfly	4	1	5
Hyperbolic Umbilic	3	2	5
Elliptic Umbilic	3	2	5
Parabolic Umbilic	4	2	6

Figure 3: The cusp and butterfly catastrophes have been used to model the political processes associated with the Russian revolutions of 1917 as described by Trotsky.

$$V_C = x^4 / 4 + a x^2 / 2 + b x \quad (1)$$

$$P_C = k \exp(-(x^4 / 4 + a x^2 / 2 + b x)) \quad (2)$$

Zeeman (1978a) has introduced the concept of conflicting factors (represented by the symbols (α) and (β)) to model the impact of conflicting factors or influences on overall system behavior. The relationship between the control (a and b) and conflicting factors (α and β) is shown in equations (3), and graphically in Figure 4. In the following discussion, specific values of the conflicting factors will be used to represent the strengths of entities that are referred to as the *Out of Power (OPS)* and *In Power (IPS)* segments, respectively.

$$a = -(\alpha + \beta)/2 \quad \text{and} \quad b = (\alpha - \beta)/2 \quad (3)$$

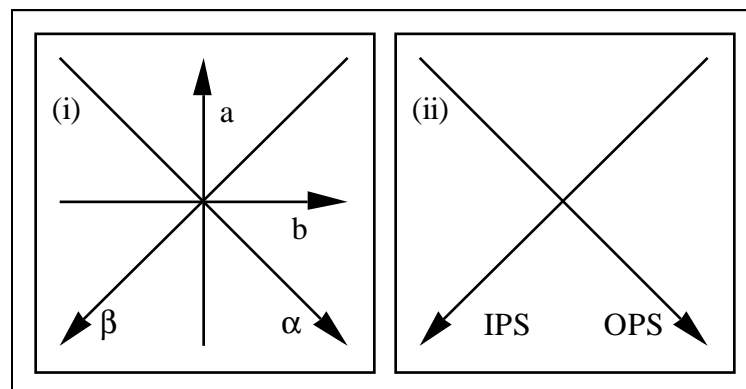


Figure 4: Control factor axes (a) and (b) define positions on the control plane of the cusp catastrophe. Conflicting factor axes (α) and (β) are rotations of the control axes and represent the impact of conflicting influences such as the strengths of the Out of Power (OPS) and In Power (IPS) segments on political behavior.

The potential function (V_B) and probability distribution (P_B) associated with the butterfly catastrophe are shown in equations (4) and (5), respectively. In these cases, (x) represents the behavior dimension and (a), (b) (c), and (d) the control factors. In the models below, the control factor (c) will be identified with the *degree of external influence* on the behavior of a society of interest. The control factor (d) will represent the *balance of coercive force* and that force may favor either the in- or the out-of-power segments of a society.

$$V_B = x^6 / 6 + c x^4 / 4 + d x^3 / 3 + a x^2 / 2 + b x \quad (4)$$

$$P_B = k \exp(-(x^6 / 6 + c x^4 / 4 + d x^3 / 3 + a x^2 / 2 + b x)) \quad (5)$$

Stationary states of systems whose behavior can be modeled with the aid of the cusp catastrophe, that is systems with two control factors and a single behavior dimension, occur when $dV_C/dx = 0$, that is, when:

$$dV_C/dx = x^3 + a x + b = 0 \quad (6)$$

Such systems tend toward conditions where their potential energy is minimized or their probability distribution is maximized. Equation (6) can have either one or three stationary values depending on the values of the factors (a) and (b). When the system has three stationary values, two of them can be shown to be stable, the other state unstable. The folded sheet-like construct shown in Figure 5 is the cusp catastrophe landscape. The catastrophe landscape will be called the *political landscape* for this research application. The landscape represents the ensemble of stationary state values of the potential function or probability distribution for the set of control factor values defined by the control plane. The control plane of the catastrophe is represented below the landscape as a projected rectangular entity. The pointed (or cusp-shaped) structure on the control plane is the shadow formed by the edges or the cliff of the landscape. It is technically known as the *bifurcation set* of the catastrophe.

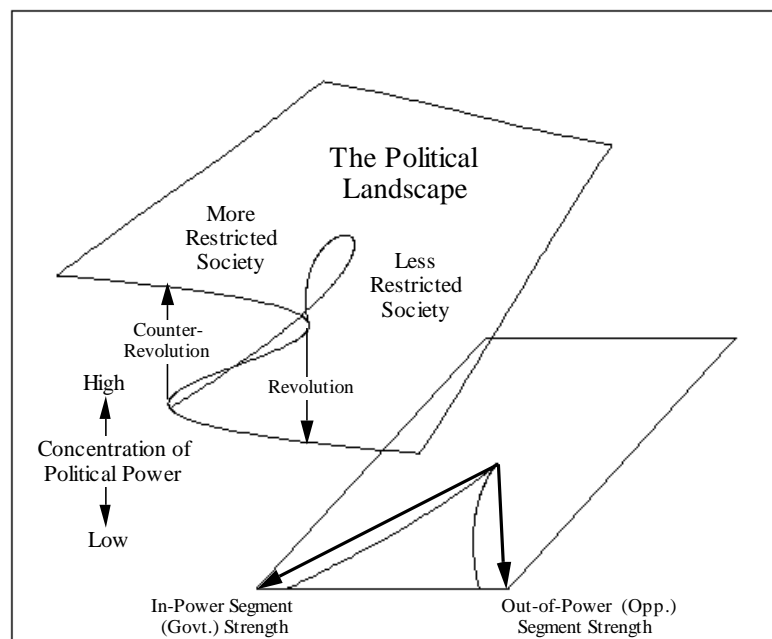


Figure 5: The Political Landscape represents the effect of the interaction between the In Power (IPS) and Out of Power (OPS) segments of a society.

The relative 'height' of the landscape represents the value of the behavior dimension or variable. Thus higher levels correspond to increased concentrations of political power within the overall society, caused by significant support for the In Power Segment, for example. Lower levels on the landscape represent lower concentrations of political power reflecting significant support for the Out of Power Segment, for example. Some regions of the landscape have two upward facing layers corresponding to two different and competing stable stationary political situations. These conditions are the basis of the concept of dual sovereignty, described by Trotsky as a necessary precursor for revolution. The intermediate sheet in the landscape construct under the cliff represents unstable political conditions.

Political conditions are assumed to be determined by the relative strength of the In Power (IPS) (or government) and Out of Power (OPS) (or opposition) segments or entities of the overall society. Specific positions on the political landscape represent the outcome of the interaction or conflict between the In Power and Out of Power segments in much the same way that latitude and longitude determine position on a geographical landscape. Changes in the relative strengths of these political segments cause movement on the political landscape as the political coordinates change and may lead to either gradual or sudden changes in behavior. Revolutions are illustrated in the landscape model by movements that cause a sudden transition from the upper to the lower layer of the political landscape caused by a relative increase strength of the Out of Power Segment. Counter-Revolutions, by contrast, are illustrated by sudden transitions from points on the lower surface under the cliff, to a higher part of the landscape due to a relative increase in the In Power Segment strength.

In order to examine the political dynamics in more detail, selected values representing different In Power and Out of Power Segment strengths were used to calculate cusp catastrophe probability distribution (P_c) curves based on the relationship shown in equation (2). A selection of these curves, called *political power concentration curves* are shown in Figure 6. These curves can be thought of as representing the result of a notional public opinion poll in which individuals were asked to select their favored form of political structure for their society. In this case, the selection would range from conditions in which the power would be concentrated in the hands of a small ruling elite at one extreme to conditions where power was distributed very widely throughout the society with everyone having a measure of such power, at the other extreme. Each peak in the curve can be considered to represent a distinct focus of political power within the society.

The political power concentration curves displayed in Figure 6 were drawn with the assumption that the values of the In Power and Out of Power Segments ranged arbitrarily from 0 (no strength) to 2 (maximum strength). Positive values are assumed to represent involvement directed outward from the segment, negative values would represent internal involvement directed within the segment. In any event, the political power concentration curves shown in Figure 6 exhibit the following important features.

1. *A Type 1 Society:* A relatively strong Out of Power Segment creates a society characterized by a support for a relatively wide distribution of power. This could involve creation of political a environment arbitrarily characterized as a Type 1 society in which the In Power Segment was subjected to strong control by the Out of Power segment (Figures 6 and 7).
2. *A Type 2 Society:* A relatively strong In Power Segment creates a society characterized by a concentration of power. This could involve creation of a

political environment arbitrarily characterized as a Type 2 society in which the Out of Power segment was subjected to strong control by the In Power Segment (Figures 6 and 7).

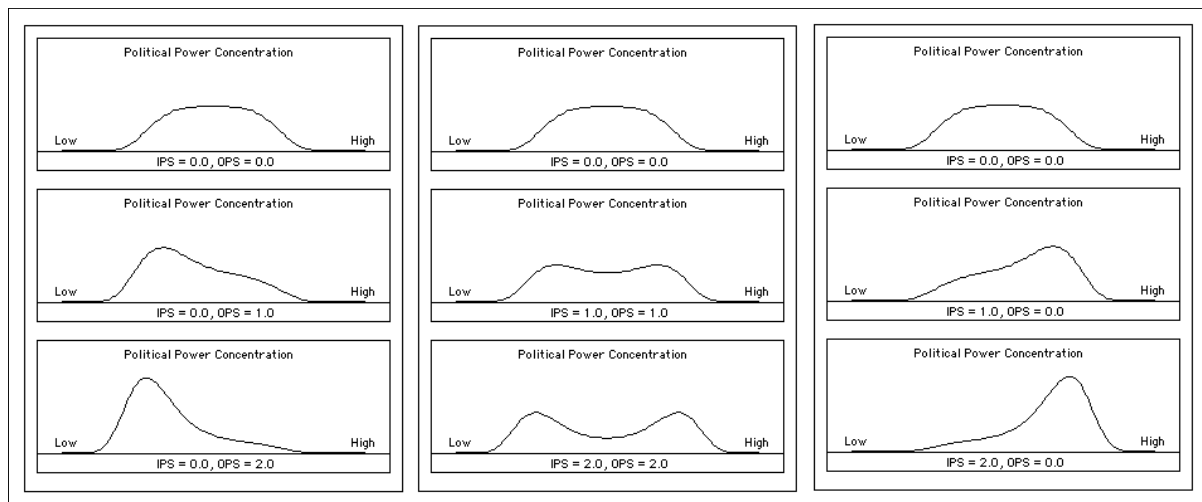


Figure 6: Political power concentration curves reflecting the impact of different strengths of the In Power and Out of Power Segments on a notional society.

3. *A Mixed Type 1 and Type 2 Society:* Increasing strengths of both In Power and Out of Power Segments transforms a broad political power concentration curve representing support for an indeterminate form of political arrangement into one with two distinct peaks (Figure 6). One peak reflects the support for a relative concentration of political power (Type 2, Figure 7), the other a wider distribution of power within the society (Type 1, Figure 7). As mentioned earlier, and described in more detail below, such conditions constitute a form of dual sovereignty, defined by Trotsky as a necessary precursor to revolution. Within a dual sovereignty, two types of political structure can compete for state power.

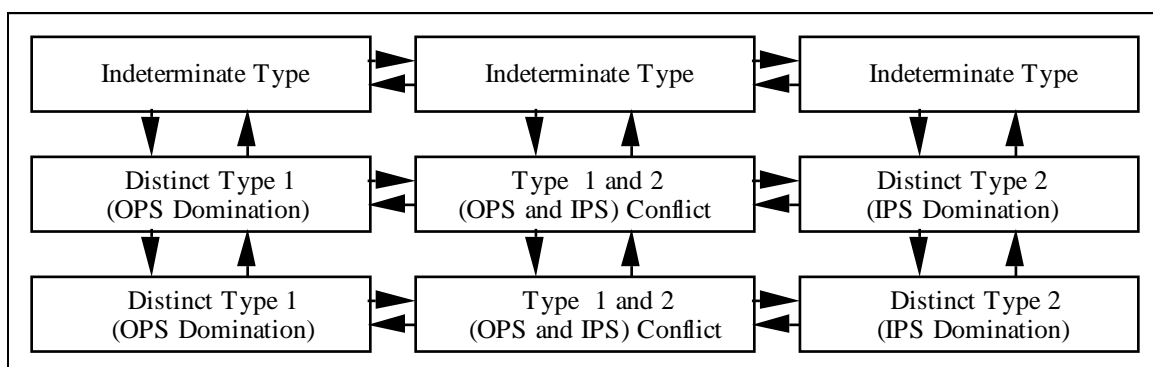


Figure 7: The nature of the political environment is determined by the relative strength of the In Power and Our of Power Segments.

The butterfly catastrophe can model the behavior of systems with up to four control factors and a single behavior dimension. Stationary states of the butterfly catastrophe occur when $dV_B/dx = 0$, that is, when:

$$dV_B/dx = x^5 + c x^3 + d x^2 + a x + b = 0 \tag{7}$$

Analysis demonstrates that the butterfly catastrophe can exhibit up to five stationary state conditions (three stable, two unstable) for particular values of the (a), (b), (c), and (d) control factors. Figure 8 provides a representation of the four control factors of the butterfly catastrophe with two of the factors modified to reflect the impact of conflicting factors on overall behavior. Selected political power concentration curves based on equation (5) have been drawn for different values of control factors representing In Power and Out of Power Segment strengths, the Balance of Coercive Force, and the Degree of External Influence on a society of interest (Figure 9). Coercive force balances can support either the In Power or Out of Power Segments. It is assumed that the net External Influence can be directed inward from the external world to the society, or outward from the society to the wider world.

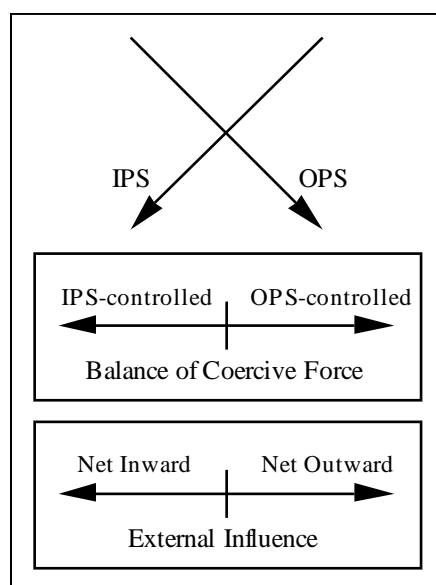


Figure 8: Models based on the Butterfly catastrophe involve the impact of four key influences identified here as the strength of the In Power (IPS) and Out of Power (OPS) segments, the balance of coercive control, and the degree of external involvement in the political process.

Inspection of Figure 9 reveals an additional pattern in some of the political power concentration curves compared with those generated by the two control factor model based on the cusp catastrophe and shown in Figure 6. The most significant difference between the cusp- and butterfly-based curves is the emergence of a third peak between the two peaks representing Type 1 (OPS-dominated) and Type 2 (IPS-dominated) societal conditions. This third peak could represent creation of a third (Type 3) focus of political power within the society, something that Trotsky has referred to as reflecting the action of “Compromisers.” Such a compromise position would reflect support for a moderate concentration of power. As well as the types of political condition identified for the two-factor- (cusp catastrophe) based model, it is possible to identify at least the following additional political situations based on the four-factor (butterfly-catastrophe) model.

1. *A Type 3 Society* in which the political environment is dominated by large amounts of support for a Type 3 or compromise position.

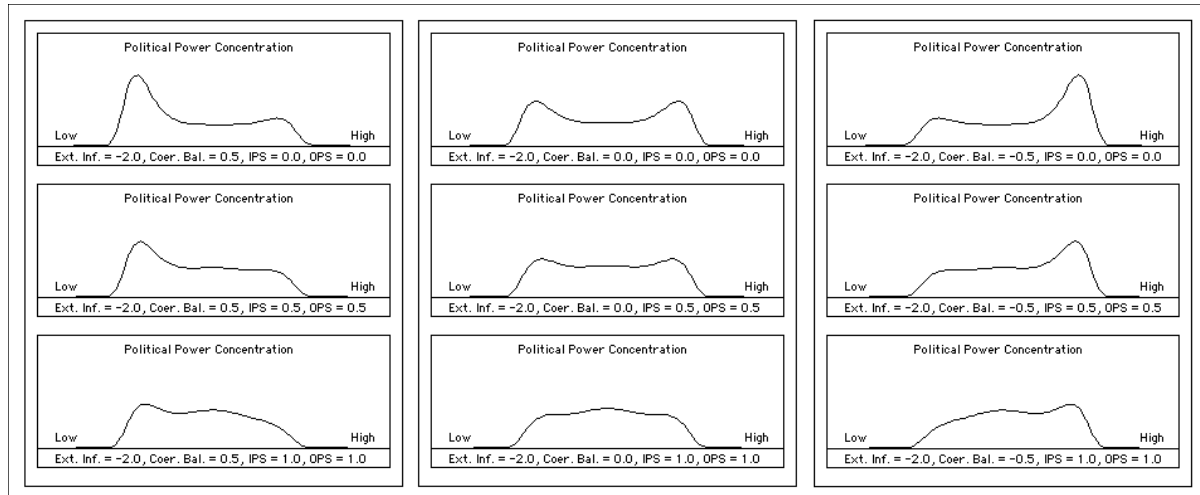


Figure 9: Political power concentration curves reflecting the impact of In Power and Out of Power Segments, Balance of Coercive Force, and External Influence.

2. A *Mixed Type 1 and Type 3 Society* would involve competition between support for the widespread distribution of power characterised by the position of the Out of Power (or Type 1) segment and the relatively more moderate compromise (or Type 3) distribution of political power within a society.
3. A *Mixed Type 2 and Type 3 Society* would involve competition between support for the narrow distribution of power characterised by the position of the In Power (or Type 2) segment and the relatively more moderate compromise (or Type 3) distribution of political power within a society.

These different patterns of political power concentration (or distribution) can be represented by specific locations on a political landscape generated by the butterfly catastrophe. Selected examples of such situations will be provided below during development of models of the Russian revolutions of 1917.

METAPHORS AND MODELS OF REVOLUTION

The Russian revolutions of 1917 produced an initial transfer in February of state power from an authoritarian dictatorship under the Tsar in the February Revolution to a form of bourgeois-socialist government first under Prince Lvov, and then under Kerensky. Subsequent events led to the overthrow of that government and the formation of what Trotsky calls a “dictatorship of the proletariat” under Lenin’s leadership in the October Revolution. An earlier study undertaken by Woodcock (1987) demonstrated that it was possible to use the techniques of catastrophe theory outlined above to study the processes of political change and revolution. The nature of the Theory is described in much greater detail by Thom, 1972; Zeeman, 1978a; Poston and Stewart, 1978; Wildgen, 1982; Woodcock and Poston, 1974; Cobb and Zacks, 1985; and Woodcock and Davis, 1978 for example. The elementary catastrophes provide a canonical set of models of systems of interest. As mentioned above, those models can illustrate the behavior of systems under the influence of a

limited number of key variables where the components of the system interact to minimize some form of potential function or maximize some form of probability distribution.

An important insight into the applicability of catastrophe theory for such purposes came from my detailed reading of *The History of the Russian Revolution (HRR)* by Leon Trotsky (published in an English translation initially in 1932 and subsequently in 1961). As I read the history of those revolutions, I noticed the widespread use of geometric, landscape-like, and other physical metaphors to represent the processes of political change. The key moment came when he read Trotsky's statement that "... a revolution never moves on diagonals" (*HRR*: v. 3, p. 307) as Trotsky described the dynamics of the overthrow and capture of the Kerensky Regime at the Winter Palace in Moscow during the October Revolution. I knew that such behavior could be modeled with the aid of catastrophe theory, and focussed on the prospect that other descriptions could be modeled with that theory.

During my study of *HRR*, I discovered many other examples where Trotsky's metaphors could be modeled or illustrated by catastrophe theory. Several of these examples are presented below; others will be published elsewhere in due course. As I collected these examples and developed initial catastrophe theory-based representations that captured the essence of Trotsky's words, I asked myself the following question: Is it possible to use catastrophe theory to provide a representation of the internal, nervous system-based, model of external processes and behaviors created in the brain of a skilled observer? If those internal models represented the interplay of a limited number of key variables or properties then the properties of those internal, neural-based, models should be at least topologically equivalent to one of the elementary catastrophes. Seeing that the formulation of the theory did not preclude such modeling, I then proceeded to develop catastrophe theory-based representations that reflected Trotsky's descriptions of the processes of political revolution.

Capturing the essence of Trotsky's metaphors with the aid of catastrophe theory would be particularly appropriate if he appeared to be observing the interplay of a relatively limited number of factors in determining overall political behavior within Russia. It is clear that while in opposition to the government he was particularly concerned with the political strength of the government and that of the different opposition entities. He was also vitally concerned with who controlled the different security forces, including the army, navy, and the police. Trotsky's references to external influences are relatively less marked, but he does mention the influences of the First World War and the investments in Russia that were owned by external entities. While it is completely possible that he considered other influences, it is apparent that the majority of *HRR* is focussed on a discussion of the nature and effect of a relatively few major influences on the political process.

Zeeman (1978b) has described two procedures for the construction of models of systems with behavior that can be represented by catastrophe theory. The first procedure involves the collection of extensive amounts of data and the use of specific groups of those data to construct portions of a catastrophe landscape or manifold surface that reflects the nature of behavior of a process of interest. The drawback of this procedure is that it cannot be used to generate a set of equations that can be used to model the overall behavior of that process. Zeeman describes a second procedure that essentially uses the properties of a canonical catastrophe model which can be justified by Thom's theorem (Thom, 1972, and Poston and Stewart, 1978, for example) to guide the construction of a specific model for the situation of interest that can incorporate available data. While this second procedure may not permit precise fitting of available data, it does support use of Thom's theorem to generate algebraic

equations that can be used to give insight into the underlying processes responsible for overall system behavior.

NEURO-ARCHEOLOGICAL ANALYSIS OF TROTSKY'S DESCRIPTION OF THE RUSSIAN REVOLUTIONS OF 1917

With this brief introduction to some of the properties of catastrophe theory and how the theory can be used to provide generic models of the political process and the causes and effects of political change, we turn to a discussion of the Trotsky's description of the Russian revolutions of 1917 and to the concept of Neuro-Archeology. Elements of the second type of process of model-building described by Zeeman (1978b) were adopted in the study of Trotsky's interpretation of the Russian revolutions of 1917. In this case, evidence of the nature of the internal models created by Trotsky will be sought in the words that he used to describe and react to the events associated with the Russian revolutions. Consideration of the following important examples of Trotsky's political metaphors will involve presentation of several key quotations on a particular topic and the discussion and illustration of those quotations with the aid of concepts based on catastrophe theory.

1. The correlation of forces and the observation that a revolution never moves on diagonals.
2. Dual Sovereignty and the mechanism of revolution
3. The dynamics of the February revolution.
4. The paradox of the February revolution.
5. Three outcomes were theoretically possible.

THE CORRELATION OF FORCES AND "A REVOLUTION NEVER MOVES ON DIAGONALS"

The concept of the "correlation of forces" figures prominently in the writing of Trotsky and constitutes a major foundation of Bolshevik doctrine. The correlation of forces represents an assessment of the relative capability of two opposing political entities or groups. It can be represented in terms of a vector diagram in which the magnitude of each of two opposing forces is represented by the length of a vector line (Figure 10). Trotsky states that "*the proletariat can become imbued with the confidence necessary for a governmental overthrow only if it [can] ... test out in action a correlation of forces that is changing to its advantage ...*" (HRR: v. 3, p. 174). Trotsky also states, that while the events associated with a revolution may be chaotic, it is only an apparent chaos and that "*beneath it is proceeding an irresistible crystallization of the masses around new axes ...*" (HRR: v. 1, p. 131).

Changes in the relative strengths of the government and the 'masses' can be represented by changes in the relative lengths of the vector lines representing the strengths of these opposing political forces. The combination of the separate force vectors into an overall vector

can provide a representation of the overall political environment, and the pattern of changes in the magnitude and direction of this political force vector can indicate future patterns of change. Since these force vectors represent the strengths of opposing political entities, they can also provide the basis for the conflicting factor axes in models of political change based on catastrophe theory.

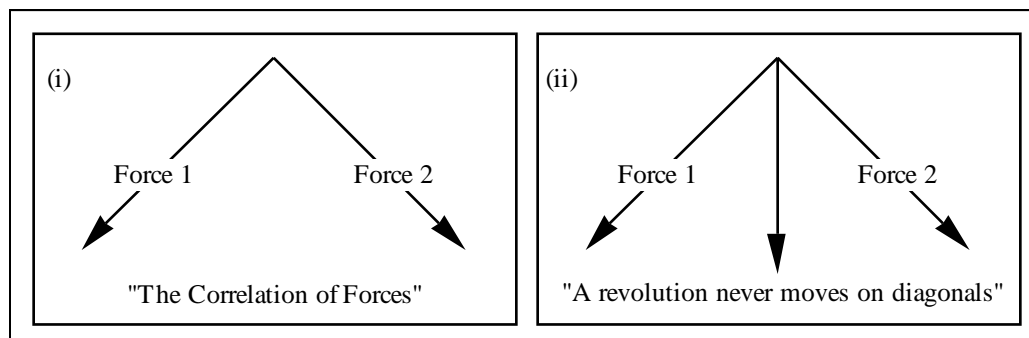


Figure 10: A force vector representation of the concept of the correlation of forces and its use to illustrate the concept that “a revolution never moves on diagonals” described by Trotsky.

In Trotsky’s description of the overthrow of the Kerensky regime on October 25th 1917, he observes that the All-Russian Congress of Soviets, which convened in the morning before the Winter Palace fell and the Kerensky regime was arrested, that “*a high tension current runs through the Congress, which now suddenly feels and realizes what it really is, the convention of a civil war*” (HRR: v. 3, p 306). He also observes that attempts at forming a united front of Mensheviks, Social Revolutionaries, and Bolsheviks at the Congress failed because “*a revolution never moves on diagonals*” (HRR: v. 3, p. 307) (emphasis added) and that “*a union of all genuinely revolutionary elements ... is necessary*” (HRR: v. 3, p. 313). After a short delay in the proceedings of the Congress, news of the arrest of the whole of the Provisional Government, with the exception of Kerensky, was announced. Thus, “*The leap over the abyss dividing the revolutionary class from power has been made ... The deed is done ... the enemy’s staff is made prisoner*” (HRR: v. 3, p, 314). The Congress then assumed state power and “*the most important and necessary things got done. Replacing the old web of administration, the first threads of the new were strung. The revolution grew in strength*” (HRR: v. 3, p. 322).

The concept that ‘a revolution never moves on diagonals’ is illustrated with respect to the correlation of force axis diagram in Figure 10, and also in Figures 11 and 12. Figure 10 shows that the diagonal associated with the correlation of force axis lies in between the two opposing force (in and Out of Power Segment) axes. In the catastrophe-based political landscape diagram shown in Figure 11, the ‘diagonal’ of the political force vector is seen to describe paths that generally do not cross the cliffs on the landscape along trajectories that would represent some form of revolutionary transition. Rather the ‘diagonal’ follows paths that avoid the edges of the cliff and thus avoid revolutionary transitions. There are three types of trajectories on the surface that are available under these circumstances: (1) A trajectory that follows the middle (unstable) layer of the surface (under the cliff) on the path (a-b). (2) A trajectory on the lower surface (corresponding to increasing political power dispersion on the path (c-d). (3) A trajectory on the upper surface (corresponding to increasing political power concentration on the path (e-f).

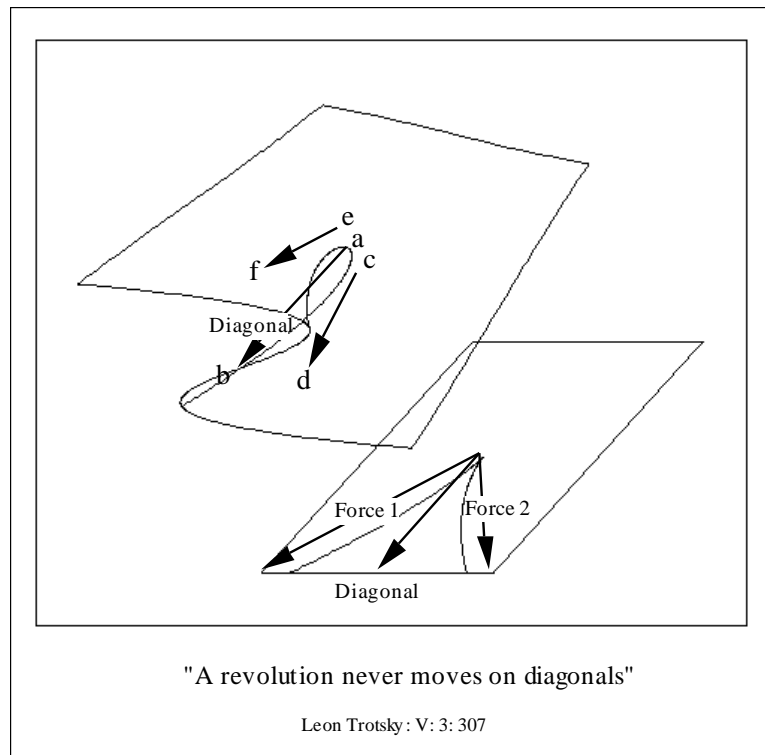


Figure 11: Movement on a ‘diagonal’ generally never crosses the cliff on the political landscape, and thus never creates revolutionary transitions.

Figure 12 clearly shows that in order for a political trajectory to cross a ‘cliff’ associated with the political landscape, movement has to occur at some angle to the ‘diagonal.’ Such off-diagonal trajectories represent a relatively rapid decline in the strength of or support for one of the entities involved in the overall political process. The transition from one layer of the political landscape through a revolutionary transition captures the essence of Trotsky’s description of the ‘great leap over the abyss’ mentioned earlier. These discussions have demonstrated that it is possible to interpret and illustrate the words used by Trotsky to describe some aspects of the process of revolution with the aid of catastrophe theory-based constructs, additional uses of the theory for that purpose follow.

DUAL POWER OR SOVEREIGNTY AND THE MECHANISM OF REVOLUTION

In describing the mechanism of revolutionary change, Trotsky observes that the “*political mechanism of revolution consists of the transfer of power from one class to another*” (HRR: v. 1 p. 206-7) and that the “*character of a political structure is directly determined by the relation of the oppressed classes to the ruling class ... A single government, the necessary condition of stability in any regime, is preserved as long as the ruling class succeeds in putting over the economic and political forms upon the whole of the society as the only forms possible*” (HRR: v. 1, p. 206). Furthermore, “*Society needs a concentration of power ... The splitting of sovereignty foretells nothing less that a civil war. But ... the competing classes and parties ... may ... endure [for a period] ... a two power system [which] will nevertheless inevitably explode*” (HRR: v. 1, p. 208). Trotsky also identifies a condition of

dual power or dual sovereignty as a necessary precursor to revolution: “*The two-power regime arises only out of irreconcilable class differences — is possible only in a revolutionary epoch, and constitutes one of its fundamental elements*” (HRR: v. 1, p. 206). Furthermore, “*A revolution becomes possible only in the case that the society contains a new class capable of taking the lead in solving the problems presented by history* (HRR: v. 3, p. 173-4). Further, Trotsky reports Lenin’s statement that it is necessary “*To have at the decisive moment, at the decisive point, an overwhelming superiority of force*” and that “*this law of military success is also the law of political success ... especially in ... [a] revolution*” (HRR: v. 3, p. 179).

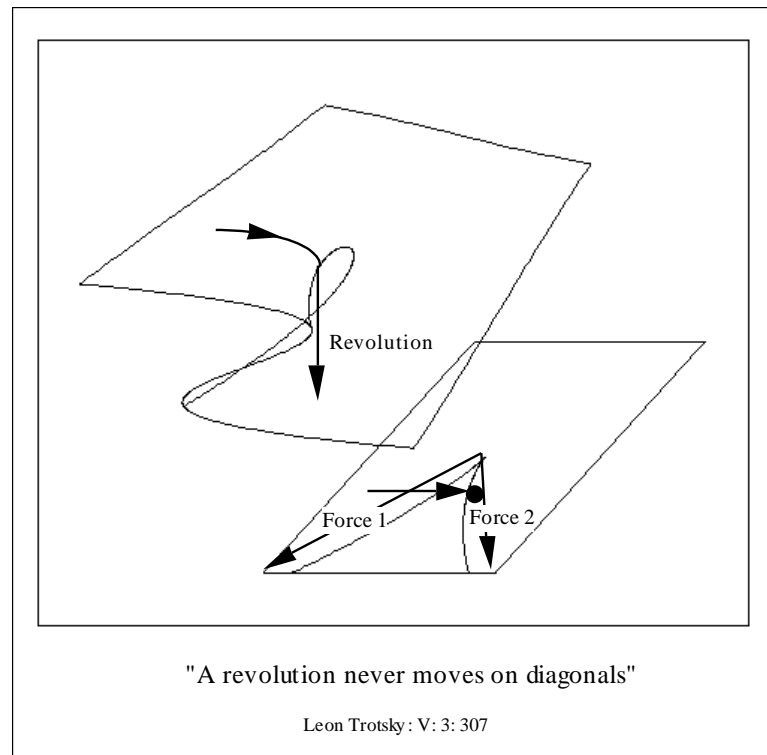


Figure 12: Revolutionary transitions occur only when movement on the political landscape takes place at an angle to the ‘diagonal’ described by Trotsky in ways that lead to a crossing of the cliff on the political landscape as illustrated above.

These descriptions by Trotsky of the revolutionary process can be illustrated with the aid of elements drawn from catastrophe theory. The concept that a ‘new class’ representing the formation of a ‘dual sovereignty’ is needed to undertake a revolution is illustrated in Figure 13. This Figure shows the emergence of two foci of political power that can compete for state power. One of these foci can represent an entrenched In Power Segment, the other the Out of Power Segment seeking, at least initially, the wider dispersion of power within the society. The effect of weakened support for an In Power entity and growth in strength of an Out of Power entity is illustrated by the series of power concentration curves shown in Figure 14. Here the initially high level of support for the positions of the In Power entity becomes progressively reduced and the level of support for the Out of Power entity increases. The dominant In Power structure is replaced by a condition of dual sovereignty with equality of support, and then by a condition of Out of Power entity domination. It can be assumed that destruction of the peak in the curve associated with the In Power entity constitutes the revolutionary overthrow of that entity and its replacement with the Out of Power entity.

These events are also illustrated by paths on the political landscape that cross and ‘fall off’ the cliff. Elements of the initially Out of Power entity may form a new In Power entity, and the pattern of support for the new structure, illustrated by a new power concentration curve, would reflect the new political reality.

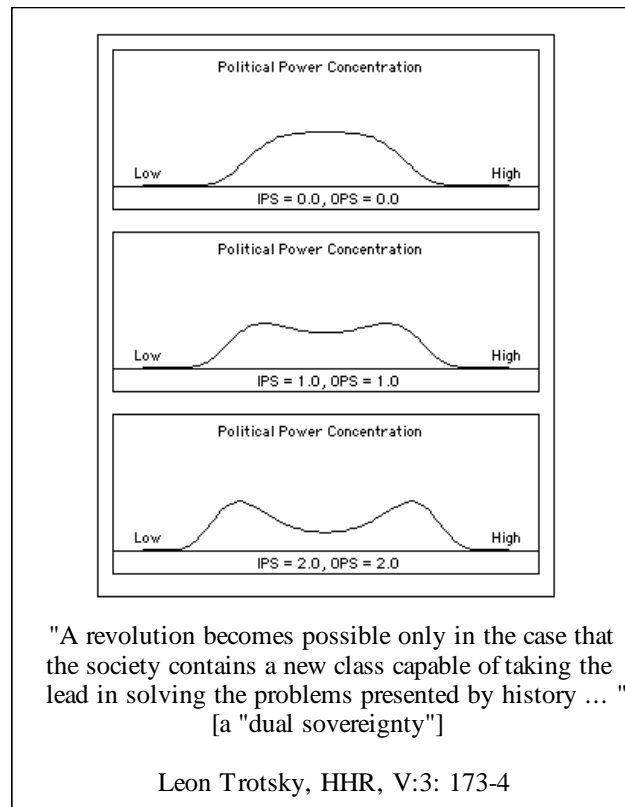


Figure 13: Political power concentration curves illustrate the emergence of a dual sovereignty, considered by Trotsky to be a necessary precursor to revolution.

Trotsky observes that “*The development of a revolution lays bare at each new stage the problem of power ... A counter-revolution has the same dynamic, except that the picture is reeled off in the opposite direction.*” (HRR: v. 2. P. 250). The counter-revolutionary process can be illustrated with a series of power concentration curves (Figure 15). In that case, The changes in the shape of the power concentration curve reflect increased levels of support for a political structure in which power is concentrated in the hands of a relatively small group within the overall society. Power concentration curves can also be used to illustrate another political phenomenon, the emergence of a ‘third power’ described by Trotsky as he outlined the events associated with what he describes as the “April Days.” During the April Days as the turmoil created by the February revolution continued, Trotsky points out that “*It was becoming harder and harder to live. Prices had risen alarmingly, the workers were demanding a minimum wage; ... the food situation was growing worse ... there was ferment in the masses*” (HRR: v. 1, p. 334). Then: “*amid all this ritual diddling of the double sovereignty, a third power unexpectedly intervened*” (HRR: v. 1, p. 340). The emergence of a third power is illustrated with the power concentration curves shown in Figure 16. In this case, the third power is represented by a third peak intermediate between the two peaks illustrating a dual sovereignty. Significant support for an intermediate (third power) position can facilitate the process or political transformation by drawing support from both extreme positions, for example.

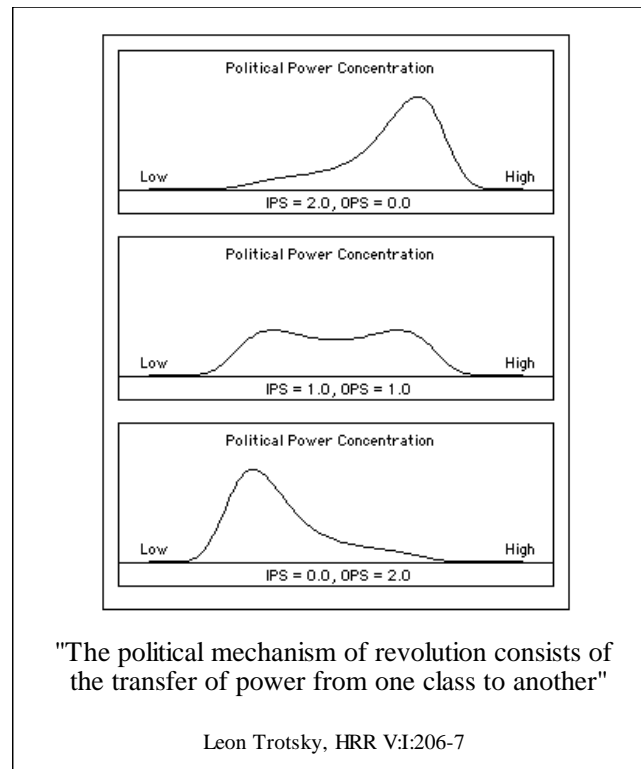


Figure 14: The revolutionary process can be illustrated by changes in the shape of the power concentration curve that reflect an increase in the dispersion of political power.

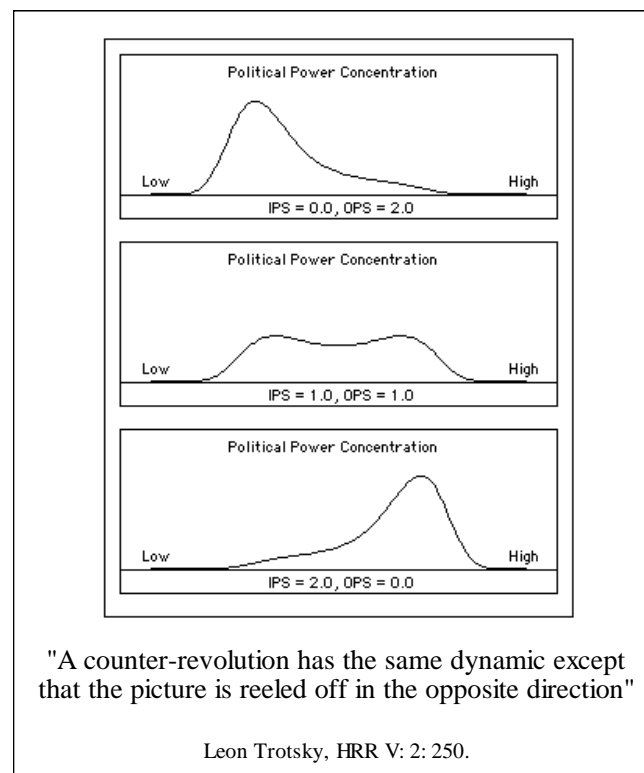


Figure 15: The counter-revolutionary process can be illustrated by changes in the power concentration curve indicating a decrease in political power dispersion.

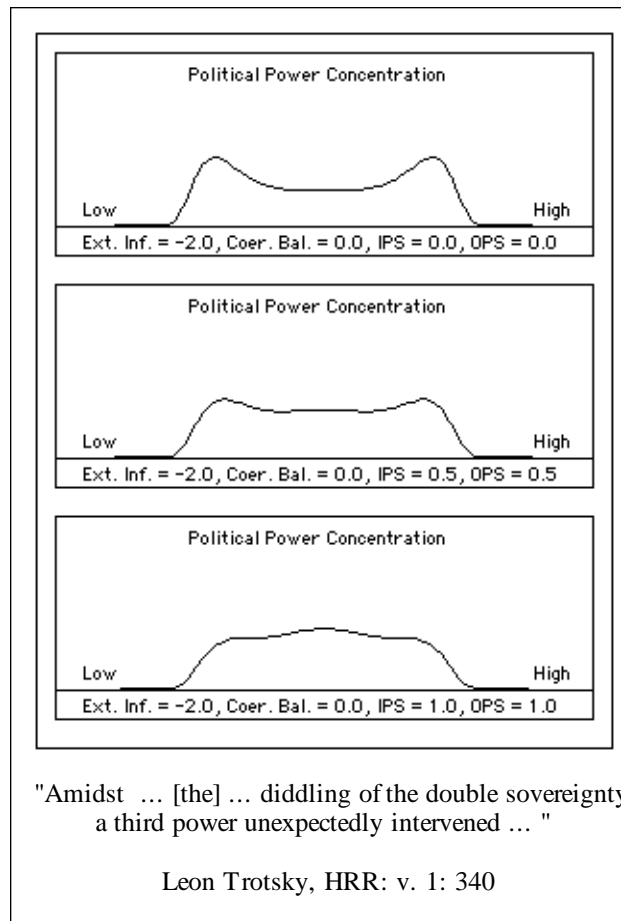


Figure 16: The emergence of a ‘third power’ can be illustrated by the creation of a third peak in the power concentration curve reflecting support for three different political structures within a society.

THE DYNAMICS OF THE FEBRUARY REVOLUTION

As I read, and re-read, the 1400 or so pages of Trotsky’s *History*, I became increasingly aware of the possibility that I might be able to move a significant way to creating actual, numerically-based, models of Trotsky’s perception of the dynamics of the processes associated with the Russian revolutions. This would be possible if I could provide an actual measure, or at least some form of assessment of the values of the following factors:

1. The strength of the In Power Segment.
2. The strength of the Out of Power Segment.
- 3; The balance of coercive force within Russia (In this case a balance in favor of the In Power Segment was represented by negative values, positive values represented a balance in favor of the Out of Power Segment).
4. The degree of external influence on Russia (Here a net inward influence was represented by negative values, net outward influences by positive values).

With numerical values of these factors based on the author's assessment of Trotsky, it was possible to construct a political landscape model (based on the four-factor butterfly catastrophe). The four factors would serve as the coordinates of the landscape. Specific assessments of political condition would provide numerical values that could be used as identified coordinates of positions on the political landscape that reflected those conditions.

It was evident that no direct measures of these, or even closely-related, factors were readily available. Since the author was interested in developing models based on his understanding of Trotsky's perceptions, a different approach was tried. This involved undertaking of an admittedly purely subjective assessment of the values representing the actual measures of the properties mentioned above on a month-by-month basis. Results of these activities would depend on the process of analysis and assessment that was adopted, and assessments by others could clearly generate markedly different results. With that as an important and necessary caveat to the reader, results from the author's assessment of the political conditions in Russia and their use to construct the political landscape for Russia in the Fall of 1916 and after the February revolution in 1917 are presented below.

The model-building process began with the construction of a monthly time-line from the information contained in *HRR* and establishment of the relationship of events described in the text to that time line. Additional reading and re-reading of the text provided information that was used to assess the values of the four factors mentioned above. The assessments were made arbitrarily with respect to scales in the range from +2 to -2. Each assessed value was re-visited numerous times, until it was felt that an adequate representation of the values associated with each of the variables had been reached. These values were then used to construct representations of the four-factor political landscape and associated control plane with the aid of a computer program developed by Woodcock. The computer program creates an orthographic projection of the landscape and control plane and plots a point (called the *state point*) on the control plane in a position corresponding to the values of the four assessed factor values (Figure 17). The program also permits the display of power concentration curves drawn for the month of the assessment displayed on the political landscape diagram. The program also displayed the curve generated with assessed data for the next time period.

Results based on the assessment of conditions in Russia in the Fall of 1916 are shown in Figure 17 and the results for February are shown in Figure 18, and described below.

1. The Fall of 1916 (Figure 17): In this case, the assessed numbers were as follows: (1). *The In Power Segment* value was 1.5; (2). *The Out of Power Segment* value was 0.5; (3) *The Coercive Force Balance* value was -0.5 (representing a balance in favor of the In Power (Tsarist) government; and (4). *The External Influence* value was -1.8 (representing a very large net inward influence on Russia).
2. February 1917 (Figure 18): In this case, the assessed numbers were as follows: (1). *The In Power Segment* value was 0.8; (2). *The Out of Power Segment* value was 1.3; (3) *The Coercive Force Balance* value was 1.5 (representing a balance in favor of the Out of Power Segment; and (4). *The External Influence* value was -1.8 (representing a continuation of the very large net inward influence on Russia).

The conditions in Russia in the Fall of 1916 as represented by the political landscape diagram in Figure 17 suggest the possibility of revolution. The ‘•’ symbol, representing the state of the system (the state point) on the control plane is located relatively close to the ‘cliff’ line (technically called the *bifurcation set*) representing conditions where sudden transitions can occur. Location of the state point to the left of the bifurcation set line implies that it is also located on the upper region of the landscape in a location representing domination by the In Power Segment associated with the Tsar and his followers. Weakening of the support for the Tsar coupled with increased support for the opposition (Out of Power Segment) and the loss of control over the security forces would move the state point closer to the edge of the cliff on the landscape reflecting an increased likelihood of revolution.

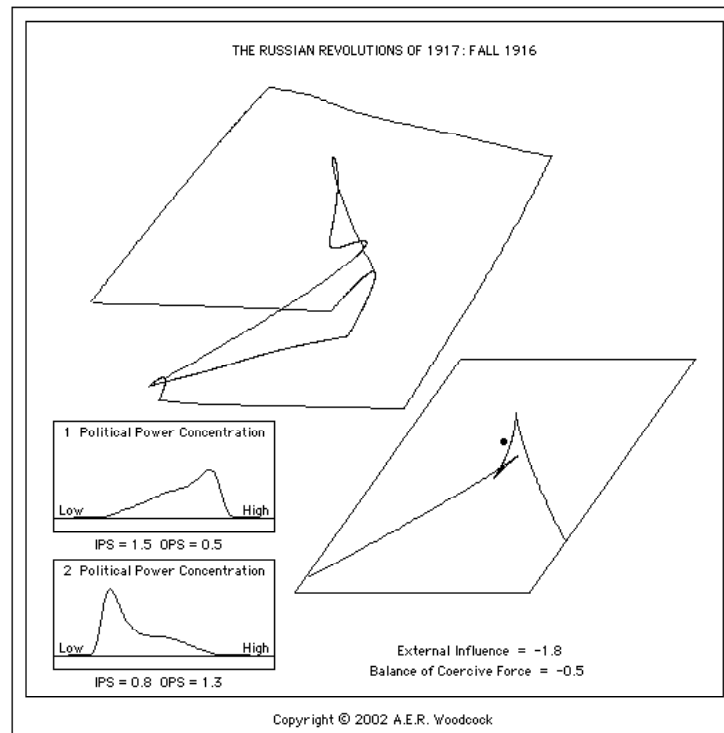


Figure 17: Political landscape representation of the situation in Russia in the Fall of 1916 based on an assessment of Trotsky’s description in *HRR* suggest the possibility of a future revolution.

Significant reductions in the level of support for the Tsar and increases in the support as well as drastic reduction in the numbers of the armed forces that remained loyal to the Tsar took place in January and February 1917. This completely undermined to position of the Tsar and set the scene for his overthrow in the February revolution. Eventually “*Generals and admirals one and all removed the tzarist braid and put on the red ribbon*” (*HRR*: v. 1, p. 89). These events are illustrated in the political landscape model shown in Figure 17. The In Power Segment strength (here still representing the Tsar and his supporters) has declined from an assessed value of 1.5 (out of 2) to 0.8. The strength of the Out of Power Segment has increased from an assessed value of 0.5 to 1.3.

A massive change in the assessment of the balance of coercive force has taken place and an initial value of -0.5 (corresponding to a relatively small balance in favor of the Tsarist, or In Power, Segment) in the Fall of 1916 has changed into an assessed value of 1.5 (corresponding to a large balance in favor of the Out of Power Segment). The assessed level of external involvement remained high at -1.8 (corresponding to a net inward influence on Russia from external entities). These changes are reflected in changes in the shape of the cliff or (bifurcation set) line and the location of the state point ‘•’ on the control plane (Figure 18). The state point now lies to the right hand side of the cliff line, indicating that a revolutionary transition has taken place and the state point is now located on the lower (power-dispersed) region of the landscape.

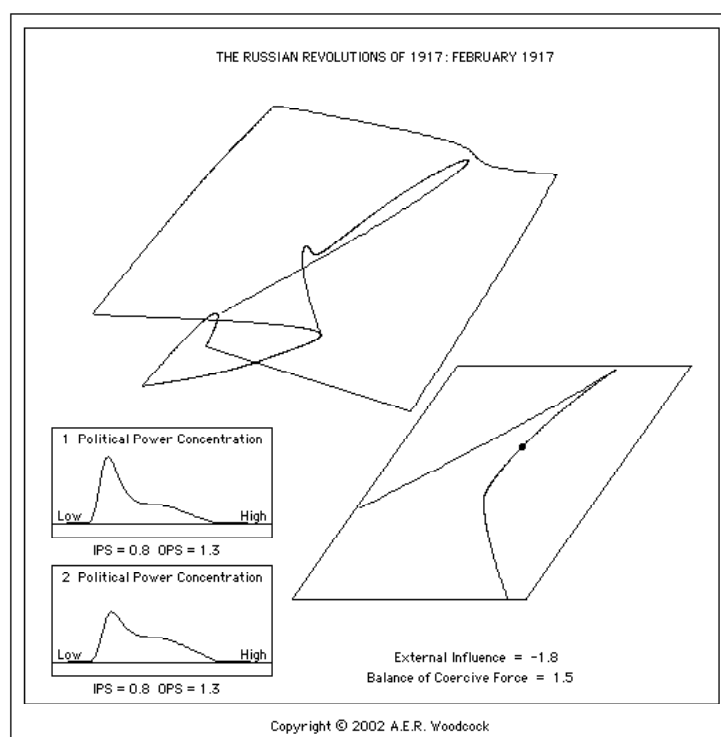


Figure 18: Political landscape representation of the situation in Russia in February 1917 based on an assessment of Trotsky’s description in *HRR* provide an illustration of the transitions associated with the February Revolution.

Additional assessments for the remainder of 1917 and for the Spring of 1918 have been undertaken and those results were presented at the Cornwallis workshop. It is hoped they will be published in due course. Suffice it to say, the transition of power from the Tsar’s

government to a Provisional Government led initially by Prince Lvov, would create new In and Out of Power Segments. Assessments of the strengths of these new segments, coupled with assessments of the balance of coercive force and level of external involvement in Russia has produced a series of additional Figures similar to Figures 17 and 18 presented above. Projection of those figures in sequence in a PowerPoint™ presentation at the Cornwallis workshop provided an enhanced understanding of the dynamics of the Russian Revolution based on Woodcock's assessment of the information presented by Trotsky in his *History*.

THE PARADOX OF THE FEBRUARY REVOLUTION

The February revolution created a paradox that appears to be hard to explain. As Trotsky observes: the February revolution triumphed but its *“leadership [that] proved sufficient to guarantee the victory [over the Tsar] ... was not adequate to transfer immediately into the hands of the proletarian vanguard the leadership of the revolution (HRR: v. 1, p. 152)*. The paradox of the February revolution was, therefore. *“that, with one single exception [the appointment of the socialist Kerensky as Justice Minister] the revolution accomplished by workers and soldiers found no reflection whatever in the staff of the revolutionary government” (HRR: v. 1, p. 183)*. Further: *“As the result of a victorious insurrection of workers and soldiers, there appeared at the helm of the government [led by Prince Lvov] a handful of the very richest landlords and industrialists ... political dilettantes without a program — and at the head of them a prince ...” (HRR: v. 1, p. 193)*.

In April, the Executive Committee of the soviets (not yet dominated by the Bolsheviks) supported the Provisional Government against the *“restless third power [that] would not be quiet” (HRR: v. 1, p. 345)* that had arisen to challenge the government. In response to this support the Provisional Government officially provided a measure of recognition of the soviets so that *“The double sovereignty that had existed in fact was thus translated into the juridical language of a constitution” (HRR: v. 1, p. 349)*. However, Trotsky observes that *“Over the Provisional Government hung the far more effective control of the Entente, which the Executive Committee did not dare to touch” (HRR: v. 1, p. 349)*.

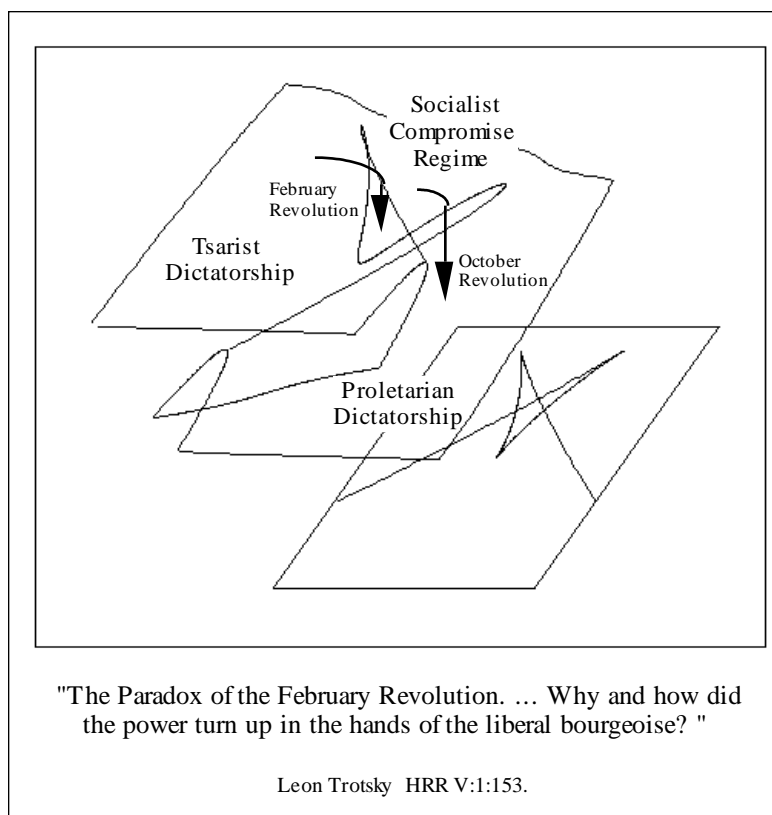


Figure 19: The shape of the four-factor political landscape can provide an explanation of why power ended up in the hands of representatives of the wealthiest segments of Russian society despite the fact that most of the revolutionary activities were carried out by the poorest segment of that society.

The shape of the four-factor (butterfly) political landscape suggests a resolution of this paradox. The existence of a high level of foreign investment and external political interest created a powerful focus of political and economic power within Russia that was beholden to those external interests and involved the richest sectors of Russian society. Such an external influence can be responsible for creating a third intermediate, or 'compromise,' layer. This layer is located between the layers of high political power concentration and low political power concentration (reflecting support for the In Power and Out of Power Segment, respectively) (Figure 19).

Under such circumstances, a revolution driven by an increase in the level of support for the Out of Power Segment can be illustrated by the trajectory on the political landscape from the upper (Tsarist Dictatorship) layer to the middle (Socialist-Compromise Regime) layer. Increased involvement of the workers and soldiers would be necessary to precipitate a further revolutionary transition to the lower (Proletarian Dictatorship) layer of the landscape. Such a transition would take place in the October Revolution (1) after Lenin had formed the Bolsheviks, and through them large numbers of workers and soldiers, into a much more coherent political weapon and (2) after a significant reduction in the level of support for the Provisional Government, then led by Kerensky, had taken place.

THREE OUTCOMES WERE THEORETICALLY POSSIBLE

Trotsky describes the changes in the distribution of political power that took place after the February revolution and in particular the reactions of the Provisional Government to the turmoil created by the partial insurrection against the government in April. After this, Trotsky observed that: “*three outcomes were theoretically possible. The power might have gone over wholly to the bourgeoisie; that could have been achieved only through civil war ... The power should have gone over wholly to the soviets; ... There remained a third possibility, the confused, weak-hearted, cowardly half-road of compromise. The name of that road was Coalition.*” (HRR: v. 1, p. 359-60).

These three outcomes can be illustrated with the aid of the four-factor political landscape model that incorporates a significant level of external involvement (Figure 20). Under such conditions, the landscape possesses an intermediate layer that represents a form of compromise between conditions that could be described as dictatorship of the bourgeoisie (on the upper layer) and a dictatorship of the proletariat (on the lower layer). Counter-revolutionary actions resulting from a significant relative increase in the support for a form of government in which power was concentrated in the hands of relatively few could have created a form of dictatorship of the bourgeoisie. By contrast, a significant increase in support for a wider distribution of power could have provided the driving force for a revolution that could lead to the formation of a dictatorship of the proletariat.

This paper has shown that it is possible to use models based on catastrophe theory to produce a representation of Trotsky’s description of the Russian Revolutions of 1917 with the aid of a method called Neuro-Archeology. These models present the dynamics of the political process as seen and recorded by Trotsky appear to capture at least the major features of the revolutionary process. The models provide illustrations for the words and concepts and demonstrate an ability to explain many key concepts including the concept of the correlation of forces and the statement by Trotsky that ‘a revolution never moves on diagonals.’ The theory provides an illustration of the concept of a dual sovereignty and a representation of the mechanisms of revolution and counter-revolution. Assessments by the author of the levels of political control factors have been used to illustrate the dynamics of the February revolution. The theory has also been able to shed new light on, and possibly explain, the paradox of the February revolution as well as to illustrate the proposition by Trotsky that ‘three outcomes were theoretically possible.’ As mentioned above, additional research has generated a complete set of illustrations of the dynamics of the complete revolutionary period from the Fall of 1916 to the Spring of 1918. These results were presented at the Cornwallis workshop and it is hoped that they will appear in print in due course.

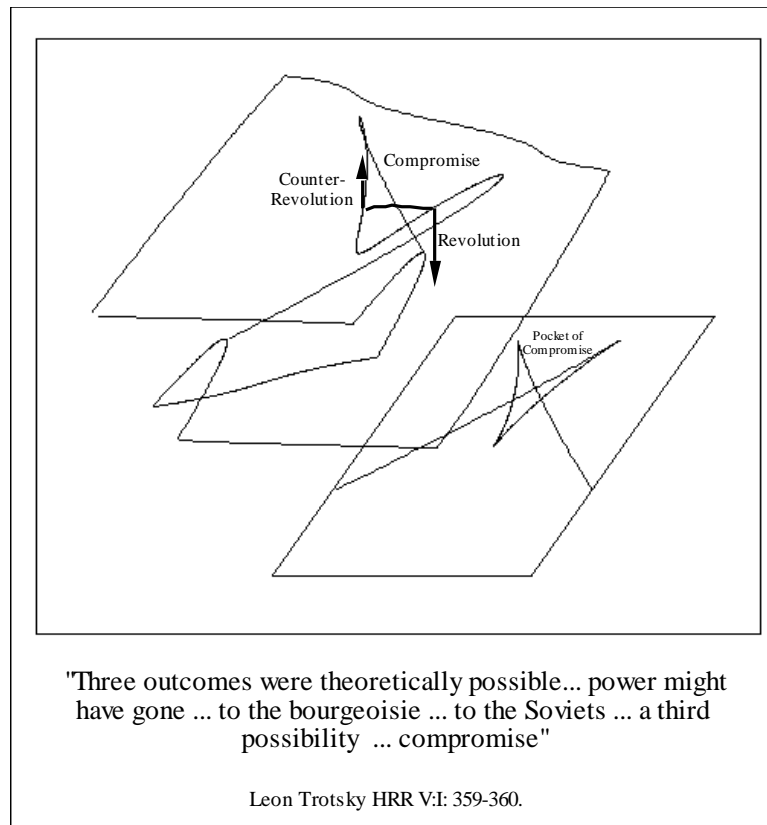


Figure 20: The middle sheet of the political landscape can serve as a starting point for counter-revolution, compromise, and revolutionary activities related to trajectories that can be identified with Trotsky's "three outcomes."

NEW ANALYSES TO SUPPORT COMPLIANCE AND PEACE BUILDING

With the above discussion as a background, it is appropriate to ask: how can such modeling and assessment activities support the overall process of compliance and peace building? In the first instance and in an idealistic context, the modeling techniques outlined above may provide assistance in the development of an understanding of the ways that friends and actual and/or potential adversaries view the world. Going the extra step of undertaking such assessments can put an individual both into the shoes, and even perhaps into the mind of others. The understanding that such activities could provide extra dimensions and perspectives that could serve to assist in the definition of criteria and mechanisms needed to support the compliance process, for example (Figure 21). Additional activities involving data collection and assessment, the creation of new models of societal activities and specialized graphics displays that aid in the development of comprehension and knowledge are all necessary components of the processes associated with compliance and peace building.

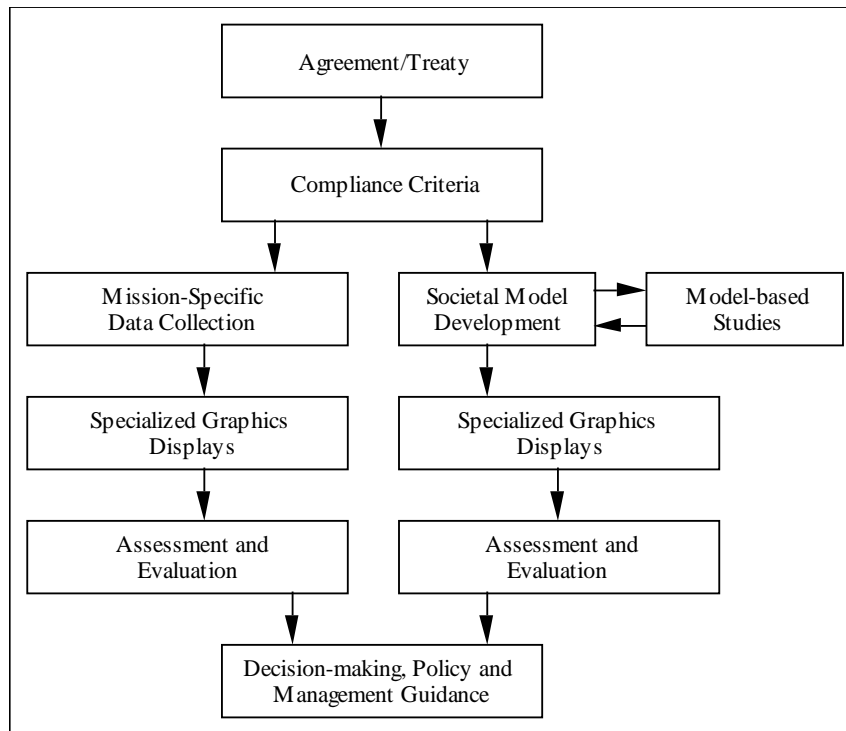


Figure 21: Model-based studies and assessments can support compliance and peace building activities.

Knowing how someone else sees the complex problems with which they are faced, may lead to the establishment of some form of common perspective or common ground of understanding. Such an understanding is needed to generate agreement on the nature of the problems faced by an overall community and to develop methods for the solution of such problems. Those activities might be used with benefit to support the processes of compliance needed to provide a foundation for the complicated tasks and activities associated with peace building in our uncertain, complex, and dangerous world.

ACKNOWLEDGEMENT

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