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A Mathematical Model of Third Party Intermediary for Conflict Resolution Process Where There Is Minimal or No Trust

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Abstract

Conflicts characterized by minimal or absent trust present a significant challenge for resolution. Traditional methods, such as GRIT (Graduated Reciprocation in Tension-reduction), often rely on a degree of pre-existing willingness to engage, which may be lacking in deeply entrenched disputes [1-3]. This article explores the critical role of a third-party intermediary in such scenarios, focusing on the modelling of their actions. We delve into the unique functions required to bridge the trust deficit, including establishing credibility, facilitating communication, and designing mechanisms for verifiable commitment. The article outlines key principles for effective intermediation, emphasizing the need for impartiality, process management, and the creation of a safe space for dialogue. By examining the significance of third-party intervention in these challenging contexts, we aim to provide a framework for practitioners and researchers seeking to navigate and resolve conflicts where trust is severely compromised [2, 3].

Keywords: Mathematical Model; Third Party Intermediary; Conflict Resolution.

1 | Introduction

Conflict is an inherent aspect of human interaction, arising from differing interests, values, or perceptions. When trust exists, parties can often navigate these disagreements through direct communication and negotiation. However, in situations where trust is minimal or entirely absent, the conflict can escalate, becoming intractable and destructive. This is particularly true in contexts involving deep-seated animosity, historical grievances, or perceived existential threats. Traditional conflict resolution methods, such as Osgood's GRIT, which relies on reciprocal, graduated tension reduction, often struggle in these environments [1]. The absence of trust undermines the willingness of parties to initiate or reciprocate conciliatory gestures, leading to a stalemate.

In such scenarios, the role of a third-party intermediary becomes paramount. The intermediary acts as a neutral facilitator, providing a structured and safe environment for communication and negotiation. Their presence can mitigate the destructive dynamics of distrust, enabling parties to engage in a process that would otherwise be impossible [1-5].

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This article seeks to model the essential functions and strategies of a third-party intermediary in conflict situations marked by minimal or no trust, focusing on the specific challenges and requirements of these contexts.

1.1 | Significance of Third-Party Intermediation in Low-Trust Conflicts

The intervention of a skilled third-party intermediary holds significant value in conflicts characterized by minimal or no trust for several key reasons:

1. Building a Foundation for Communication:
    - In the absence of trust, direct communication between conflicting parties often breaks down, leading to misinterpretations, accusations, and further escalation. The intermediary acts as a conduit, creating a structured communication channel that allows parties to express their concerns and perspectives without direct confrontation.
    - They can translate hostile language into neutral terms, clarify misunderstandings, and facilitate active listening, fostering a more constructive dialogue.
2. Establishing Credibility and Impartiality:
    - One of the primary challenges for an intermediary is to establish credibility and demonstrate impartiality. This is crucial for gaining the trust of parties who are inherently suspicious.
    - This can be achieved through transparent procedures, consistent behavior, and a demonstrated commitment to fairness. The intermediary must avoid any perceived bias or favoritism, ensuring that all parties feel heard and respected.
3. Managing the Process and Creating a Safe Space:
    - The intermediary plays a critical role in managing the conflict resolution process, setting clear ground rules, and ensuring that the dialogue remains focused and productive.
    - They create a safe space for parties to express their fears and concerns without fear of reprisal, fostering an environment where vulnerability and honesty are possible.
4. Designing Mechanisms for Verifiable Commitment:
    - In low-trust environments, commitments made by parties are often met with skepticism. The intermediary can help design mechanisms for verifiable commitment, such as phased implementation, monitoring, and third-party verification.
    - This ensures that agreements are not merely symbolic but are translated into concrete actions, building confidence and fostering a sense of progress.
5. Facilitating De-escalation and Tension Reduction:
    - The intermediary can facilitate de-escalation by encouraging parties to adopt a more conciliatory approach. They can help identify areas of common ground and facilitate the development of mutually acceptable solutions.
    - They can help to create small wins, leading to a buildup of positive momentum.
6. Breaking Deadlocks:
    - When parties are entrenched in their positions, a third party can offer new perspectives, and creative solutions. They can help to reframe the conflict, and to help the parties to see new options.

1.2 | The Catalytic Intermediary: A Chemical Analogy

In chemistry, a catalyst accelerates a reaction without being consumed itself. Similarly, a third-party intermediary in a conflict situation acts as a catalyst, facilitating resolution without directly being a party to the dispute. In both scenarios, the intermediary lowers the "activation energy" – the barrier that prevents the reactants (conflicting parties) from reaching a product (resolution).

Consider a reaction where reactants A and B react to form product C:

$A + B \rightarrow C$ (Slow reaction without catalyst) (1)

In a conflict, A and B represent the conflicting parties, and C represents a resolution. Without an intermediary (catalyst), reaching C is slow and difficult due to the high "activation energy" of distrust and hostility.

Now, introduce a catalyst (intermediary) X:

i). $A + X \rightarrow AX$ (Formation of an intermediate complex) (2)

ii). $AX + B \rightarrow C + X$ (Reaction with B, releasing the catalyst) (3)

In conflict resolution, X represents the intermediary. The intermediary first engages with one party (A), building trust and understanding. Then, the intermediary facilitates interaction with the other party (B), leading to a resolution (C) while remaining a neutral party (X).

- Key Parallels
- Lowering Activation Energy:
  - In chemistry, the catalyst provides an alternative reaction pathway with lower activation energy.
  - In conflict resolution, the intermediary provides a structured and safe environment, reducing the "activation energy" of fear, distrust, and hostility.
- Intermediate Complex:
  - The formation of AX represents the intermediary's initial engagement with one party, building rapport and understanding.
  - In conflict, this represents the initial meetings and trust building phases.
- Regeneration of Catalyst:
  - The catalyst is regenerated at the end of the reaction, ready to facilitate further reactions.
  - Similarly, the intermediary may remain available to monitor the implementation of the resolution or to address any future disputes.
- Specificty:
  - Certain catalysts are more efficient for certain reactions. Likewise, certain intermediaries are better suited for specific types of conflict.

1.3 | Mathematica Modelling

We can model this using a basic rate equation approach.

Let:

- [A], [B], [C], [X], and [AX] represent the concentrations of reactants, product, catalyst, and intermediate, respectively.

- k1, k2, and k-1 be the rate constants.

1. Formation of AX:
    - Rate = k1[A][X]
2. Breakdown of AX:
    - Rate = k-1[AX]
3. Reaction of AX with B:
    - Rate = k2[AX][B]

To model this, we'd use a system of differential equations:

- **Mathematica**

(* Mathematical Modeling of Catalytic Reaction *)

(* Define variables for concentrations and rate constants *) vars = {A[t], B[t], AX[t], C[t], X[t]}; rates = {k1, k_1, k2}; (* Define the system of differential equations *) eqns = { A'[t] == -k1 A[t] X[t] + k_1 AX[t], B'[t] == -k2 AX[t] B[t], AX'[t] == k1 A[t] X[t] - k_1 AX[t] - k2 AX[t] B[t], C'[t] == k2 AX[t] B[t], X'[t] == -k1 A[t] X[t] + k_1 AX[t] + k2 AX[t] B[t] }; (* Define initial conditions *) initialConditions = { A[0] == 1.0, B[0] == 1.0, AX[0] == 0.0, C[0] == 0.0, X[0] == 0.1 (* Initial catalyst concentration *) }; (* Define rate constants *) k1 = 1.0; k_1 = 0.1; k2 = 1.0; (* Solve the system of differential equations *) solution = NDSolve[Join[eqns, initialConditions], vars, {t, 0, 10}]; (* Extract the solutions *) Afunc = A[t] /. First[solution]; Bfunc = B[t] /. First[solution]; AXfunc = AX[t] /. First[solution]; Cfunc = C[t] /. First[solution]; Xfunc = X[t] /. First[solution]; (* Plot the results *) Plot[{Afunc, Bfunc, Cfunc, Xfunc}, {t, 0, 10}, PlotLegends -> {"A", "B", "C", "X (Catalyst)"}, AxesLabel -> {"Time", "Concentration"}, PlotLabel -> "Catalytic Reaction Simulation", GridLines -> Automatic]

1.4 | Explanation of the Mathematica Code

- Variable and Rate Definitions:
    - vars defines the concentration variables as functions of time (A[t], B[t], etc.).
    - Rates defines the rate constants (k1, k_1, k2).
- Differential Equations:
    - eqns defines the system of differential equations using A'[t] (the derivative of A[t] with respect to t). This directly translates the rate equations provided in the previous text.
- Initial Conditions:
    - InitialConditions sets the initial concentrations of the reactants, product, and catalyst at t = 0.
- Rate Constant Values:
    - The rate constants (k1, k_1, k2) are assigned numerical values. You can adjust these to explore different reaction scenarios.
- NDSolve:
    - NDSolve is used to numerically solve the system of differential equations with the given initial conditions.
    - Join[eqns, initialConditions] combines the equations and initial conditions.
    - {t, 0, 10} specifies the time range for the solution.

- Extracting Solutions:
    - The solutions for each concentration variable are extracted from the solution output using replacement rules (/. First[solution]).
- Plot:
    - Plot visualizes the concentration changes over time.
    - PlotLegends, AxesLabel, PlotLabel, and GridLines are used to customize the plot.
    - The plot will show the concentration of A, B, C, and the catalyst X over the defined time range.

1.5 | Implications and Physical Significance of Code

Let's break down the physical significance of the Mathematica code and how it translates to the practical role of a third-party intermediary in conflict situations:

1. **Concentrations as "States" of the System:**
    - A[t], B[t], AX[t], C[t], and X[t] represent the "concentrations" or "states" of the system at any given time t. In the conflict analogy, these can be interpreted as:
        - A[t]: The level of hostility or distrust of party A.
        - B[t]: The level of hostility or distrust of party B.
        - AX[t]: The degree of engagement and trust between party A and the intermediary.
        - C[t]: The progress towards conflict resolution.
        - X[t]: The "presence" or "influence" of the intermediary.
2. **Rate Constants as "Interaction Strengths":**
    - k1, k_1, and k2 represent the "rate constants," which determine the speed of the reactions. In the conflict context:
        - k1: The rate at which party A engages with the intermediary. A higher k1 means party A quickly builds trust with the intermediary.
        - k_1: The rate at which the engagement between party A and the intermediary breaks down. A higher k_1 means the trust is fragile.
        - k2: The rate at which the intermediary facilitates interaction between party A and party B, leading to resolution. A higher k2 means the intermediary is effective in moving the parties towards agreement.
3. **Differential Equations as "Dynamic Changes":**
    - The differential equations describe how the "states" of the system change over time. They represent the dynamic interactions between the parties and the intermediary.
    - For example, A'[t] == -k1 A[t] X[t] + k_1 AX[t] shows that party A's hostility decreases as they engage with the intermediary (proportional to k1) but can increase if the engagement breaks down (proportional to k_1).
4. **Initial Conditions as "Starting Points":**
    - The initial conditions (A[0], B[0], etc.) define the starting point of the conflict. They represent the initial levels of hostility, engagement, and the intermediary's presence.

5. **The Catalyst's Role:**
   - The code demonstrates how the intermediary (catalyst) facilitates the reaction (resolution) without being consumed. X[t] remains relatively constant, showing that the intermediary maintains their presence throughout the process.

1.6 | Practical Application to Third-Party Intermediation

1. **Modeling Conflict Dynamics:**
   - The code provides a framework for modeling the dynamic changes in a conflict situation. By adjusting the rate constants and initial conditions, practitioners can simulate different scenarios and explore potential intervention strategies.
   - For example, they can simulate the impact of building trust with one party before engaging with the other, or the effect of a sudden breakdown in communication.
2. **Identifying Key Factors:**
   - The rate constants highlight the key factors influencing the conflict resolution process. Practitioners can focus on strengthening the factors that promote resolution (e.g., increasing k1 by building trust) and mitigating the factors that hinder it (e.g., reducing k_1 by ensuring transparent communication).
   - By varying the rate constants, the model can show what factors have the most influence upon a resolution.
3. **Predicting Outcomes:**
   - By running simulations with different parameters, practitioners can gain insights into the potential outcomes of different intervention methods. This can help them make informed decisions about how to proceed.
   - The model can help show the results of early intervention versus late intervention, or the effect of a very trusted intermediary versus one that is not.
4. **Understanding the Intermediary's Impact:**
   - The *code illustrates the catalytic role of the intermediary*. It shows how their presence and actions can accelerate the resolution process without directly being a party to the dispute.
   - The graph of X[t] showing a relatively stable line, shows the ongoing presence of the intermediary.
5. **Visualizing Conflict Progression:**
   - The plots generated by the code provide a visual representation of the conflict's progression over time. This can be a valuable tool for communicating the dynamics of the conflict to the parties involved and for monitoring the effectiveness of the intervention.
6. **Training and Education:**
   - The model can be used as a training tool for mediators and conflict resolution practitioners. It provides a simplified but powerful way to understand the complex dynamics of conflict and the role of the intermediary.

2 | Concluding Remark

To summarize, the role of a third-party intermediary in conflicts where trust is minimal or absent is indispensable. By providing a structured and impartial framework for communication and negotiation, they can pave the way for conflict resolution and the rebuilding of relationships. The modelling of their actions and strategies is essential for developing effective interventions in these challenging contexts. In essence, the Mathematica code while it is still an elementary framework, provides a simplified yet insightful model that captures the essence of third-party intermediation. It allows practitioners to visualize, analyse, and simulate conflict dynamics, leading to more effective intervention strategies.

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All authors contributed equally to this work.

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Data Availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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