

# **Trusting the Intertwined: Modeling Enhanced GRIT Through Borromean Humanity and the Logic of Not via Coupled Riccati ODEs**

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## **Abstract**

This article extends the framework of "intertwined humanity" – conceptualized through Neutrosophic Complete Graphs and Borromean rings, and interpreted via Shigenori Nagatomo's "Logic of Not" – to propose a conceptual model for enhancing Graduated and Reciprocated Initiatives in Tension-reduction (GRIT). We posit that conflict reduction, particularly the crucial mutual increase of trust, is a deeply coupled and non-linear process that transcends binary states. By integrating the systemic interdependence of Borromean structures, the nuanced ambivalence captured by the "Logic of Not," and the inherent complexities of human interaction (as per Ubuntu), we develop a theoretical model using coupled Riccati Ordinary Differential Equations (ODEs). This approach aims to illuminate how GRIT initiatives, perceived through a "Logic of Not" lens, can shift conflict dynamics towards a stable state of mutual trust, reflecting the intertwined nature of human well-being and paving the way for more robust peace-building strategies.

**Keywords:** GRIT, Conflict Reduction, Trust Building, Intertwined Humanity, Borromean Rings, Logic of Not, Shigenori Nagatomo, Neutrosophic Complete Graphs, Coupled Riccati ODEs, Ubuntu.

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## **1. Introduction: Navigating the Labyrinth of Conflict and Trust**

Humanity's journey is perpetually marked by the ebb and flow of cooperation and conflict. From interpersonal disputes to geopolitical stalemates, the reduction of tensions and the establishment of trust remain paramount for sustainable peace. Strategies aimed at de-escalation are, therefore, crucial. Among these, Charles E. Osgood's Graduated and Reciprocated Initiatives in Tension-reduction (GRIT) stands out as a pragmatic approach designed to break cycles of mutual suspicion and foster a spiral of trust. GRIT acknowledges that in deeply entrenched conflicts, direct negotiation is often impossible due to a profound lack of trust, necessitating a unilateral, yet reciprocation-seeking, first step.

Our recent article, "Modeling Intertwined Humanity: Neutrosophic Complete Graphs, Ubuntu, and the Logic of Not" (NSS Vol. 88, 2025), established a novel framework for understanding human interconnectedness. We demonstrated how the irreducible interdependence of Borromean rings, where three entities are interlinked such that removing one frees the others, mirrors the complex web of human relationships and philosophical concepts like Ubuntu ("I am because we are"). Crucially, we introduced

Shigenori Nagatomo's "Logic of Not" as a powerful tool to describe states that defy classical binary true/false distinctions, embracing ambiguity, partiality, and contextual nuance – phenomena inherently present in the subjective interpretations of trust and distrust.

This article extends this "intertwined humanity" framework to model the dynamics of GRIT. We argue that the process of mutual trust-building in conflict resolution is not merely a linear accumulation of positive interactions but a highly coupled, non-linear system, characterized by feedback loops and nuanced interpretations. We propose a conceptual mathematical model utilizing coupled Riccati Ordinary Differential Equations (ODEs) to represent these intertwined trust dynamics. This model will incorporate the systemic understanding derived from Borromean logic, the non-binary perceptions facilitated by Nagatomo's "Logic of Not," and the foundational philosophy of Ubuntu, offering a richer, more robust understanding of how GRIT can succeed in cultivating trust for conflict reduction.

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## **2. GRIT: A Strategy for Gradual Trust Building**

The concept of GRIT was initially proposed by psychologist Charles E. Osgood in 1962, during the height of the Cold War, as a strategy for de-escalating international tensions. Facing a seemingly intractable stalemate characterized by an "action-reaction" cycle of distrust and hostility, Osgood posited a method for breaking this destructive pattern without requiring a prior agreement on mutual concessions or compromising national security.

The core principles of GRIT are:

1. **Unilateral Initiatives:** One party takes a small, verifiable, tension-reducing step without requiring a prior commitment from the adversary.
2. **Announced Intentions:** The initiative is publicly announced in advance, stating its intention as a genuine effort to reduce tension and inviting reciprocity.
3. **Graduated Nature:** The initiatives are small, non-risky, and incremental. If reciprocated, they can be followed by larger steps.

4. **Reciprocity:** The initiator explicitly invites and expects reciprocation from the other party.
5. **Verification:** The initiatives must be verifiable by the adversary to build credibility.
6. **No Withdrawal of Ability to Retaliate:** The initiator must maintain their capacity for deterrence or defense, ensuring their security is not compromised.

GRIT's power lies in its attempt to initiate a "spiral of trust" to counteract the prevailing "spiral of distrust." It aims to demonstrate goodwill, provide tangible evidence of a shift in intent, and create a psychological environment conducive to further cooperation. However, the path from a unilateral initiative to genuine mutual trust is fraught with challenges. Adversaries often view such moves with suspicion, interpreting them through a lens of past betrayals or perceived ulterior motives. It is this complex, often ambiguous, process of interpreting intentions and building reciprocal trust that demands a more nuanced modeling approach, one that goes beyond simple binary states of trust or distrust.

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### 3. Intertwined Humanity and the Borromean Logic of Conflict

Our previous work argued that human existence is fundamentally "intertwined." This concept, deeply rooted in the African philosophy of Ubuntu ("I am because we are"), posits that individual well-being and identity are inextricably linked to the collective. Applied to the dynamics of conflict, this means that the resolution of a conflict is rarely a unilateral act or a simple sum of individual concessions; rather, it is a systemic transformation of an interdependent whole.

The **Borromean rings** serve as a potent topological metaphor for this intertwined reality in conflict. Imagine a conflict involving three key issues (e.g., security concerns, economic grievances, and historical narratives) or three principal parties. In a Borromean conflict, each issue/party is bound to the others, but no two can fully resolve their differences in isolation. For instance, addressing economic grievances might be impossible without also tackling deep-seated security concerns, and vice

versa. Removing one component (e.g., one party leaving the negotiations, or one issue being arbitrarily dismissed) does not simplify the conflict into two manageable parts; instead, it causes the entire complex to unravel or collapse into a different, equally unstable configuration. This Borromean logic highlights that conflict reduction, especially through GRIT, is not about disentangling issues but about transforming the very nature of their interlinkage. A successful GRIT strategy, then, must recognize and operate within this irreducible interdependence, seeking to shift the collective equilibrium.

Furthermore, our framework utilized **Neutrosophic Complete Graphs** to represent these intertwined systems, allowing for the inclusion of indeterminacy and uncertainty inherent in complex human interactions. In a conflict context, this means that relationships, intentions, and even the "facts" of the conflict are often not purely true or false, but contain elements of ambiguity, doubt, and incompleteness. This aligns perfectly with the challenges faced by GRIT, where initiatives are often met with a mix of acceptance, suspicion, and uncertainty, rather than clear-cut trust or distrust. The "coupled-ness" of mutual trust, therefore, is not merely a functional relationship but a reflection of this profound Borromean interdependence. My trust in you is not an independent variable but is intimately shaped by our shared history, our intertwined interests, and crucially, by your perceived trust in me, forming a dynamic feedback loop that a static, uncoupled model cannot capture.

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#### **4. Nagatomo's Logic of Not: Unpacking the Nuances of Trust and Distrust**

Classical Boolean logic operates on a binary principle: a statement is either True or False. However, the complexities of human perception, particularly in high-stakes situations like conflict resolution, rarely fit neatly into such categories. Nagatomo's "Logic of Not" provides a crucial philosophical and logical tool to address this limitation. It posits that "not P" is not simply the negation of P but can represent a spectrum of possibilities that are "between" P and not-P, or a contextual "not." This allows for concepts like partial truth, degrees of falsity, and indeterminacy.

Applied to the dynamics of trust and distrust in GRIT, the "Logic of Not" offers profound insights:

- **Beyond Binary Trust:** In a conflict scenario, Party A's perception of Party B is rarely a simple "trust" or "distrust." Instead, Party A might be "not fully trusting" (i.e., harboring lingering doubts or suspicions, even after a positive initiative), or "not fully distrusting" (i.e., open to persuasion, despite a history of animosity). These are states of ambiguity that a scalar trust value (e.g., 0.6 on a scale of 0 to 1) can represent numerically, but the "Logic of Not" provides the conceptual depth, acknowledging the internal contradictions or unresolved elements within that perception.
- **Interpreting Initiatives:** When Party A takes a GRIT initiative, Party B's interpretation is critical. B might perceive it as "not clearly cooperative" (due to past betrayals), "not clearly deceptive" (because it's verifiable), and thus existing in a nuanced "not" state. This "not-ness" influences B's willingness to reciprocate. The initiative is not simply a "true" act of goodwill but might be viewed with a degree of indeterminacy or doubt, making the immediate increase in trust uncertain.
- **The Fragility of Reciprocity:** A reciprocated move from Party B might similarly be interpreted by Party A as "not fully sufficient," "not entirely convincing," or "not without ulterior motives." This persistent "not-ness" is why trust-building in conflict is so challenging and often fragile, susceptible to setbacks if these ambiguities are not carefully managed. The Logic of Not allows the model to account for these subtle psychological realities where "distrust" isn't merely the opposite of "trust" but a complex interplay of uncertainty, perceived threat, and residual skepticism.
- **Neutral States:** The "Logic of Not" also accounts for truly neutral states, where a party is "not trusting and not distrusting," reflecting a cautious wait-and-see attitude. This is crucial for GRIT, as the initial initiatives aim to move parties from active distrust to at least a neutral, receptive stance.

By incorporating Nagatomo's "Logic of Not," our model moves beyond a simplistic representation of trust as a linear scalar. Instead, it embraces the inherent fuzziness, uncertainty, and context-dependent interpretations that define genuine human interactions in conflict.

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## 5. Modeling Mutual Trust with Coupled Riccati ODEs: A Conceptual Framework

To capture the non-linear, interdependent, and nuanced dynamics of trust in GRIT, we propose a conceptual model utilizing coupled Riccati Ordinary Differential Equations (ODEs). Riccati equations are a class of non-linear first-order ODEs, often used in control theory, optimal control problems, and population dynamics, where quadratic terms allow for self-reinforcement, multiplicative interactions, and threshold effects—all characteristics relevant to trust building.

Let's define our core variables:

- $T_A(t)$ : Represents the level of trust Party A has in Party B at time  $t$ . We can conceptualize this as a continuous variable ranging from 0 (total distrust) to 1 (total trust). Or, for a more nuanced scale reflecting the "Logic of Not," perhaps -1 (strong distrust) to 1 (strong trust), with 0 representing a neutral state of "not trusting and not distrusting." For simplicity in this conceptual model, let's assume a range where higher values mean more trust.
- $T_B(t)$ : Represents the level of trust Party B has in Party A at time  $t$ .

The core idea of coupling is that the rate of change of Party A's trust in B is influenced not only by A's current trust level and its own actions, but critically by Party B's current trust level in A and B's actions.

### Proposed Coupled Riccati ODE Structure (Conceptual):

We can represent the dynamic evolution of trust for both parties as:

#### 1. For Party A's Trust in Party B:

$$\frac{dT_A}{dt} = \alpha T_A^2 + \beta T_B T_A + \gamma T_A + \delta A I_A(t) + \epsilon A S(t)$$

## 2. For Party B's Trust in Party A:

$$dTB/dt = \alpha_B TB^2 + \beta_B TA + \gamma_B TB + \delta_B IB(t) + \epsilon_B S(t)$$

Let's break down the conceptual meaning of each term and parameter:

- **$\alpha_i T_i^2$  (Self-Reinforcement/Quadratic Term):**
  - $\alpha_A, \alpha_B$ : Coefficients representing the self-reinforcing nature of trust (or distrust). If  $\alpha$  is positive, higher existing trust (or a positive trust value) leads to an accelerated increase in trust. If  $\alpha$  is negative, it could represent how existing distrust becomes harder to overcome. This quadratic term captures the non-linear "snowball effect" or "downward spiral" often observed in trust dynamics.
- **$\beta_i T_j$  (Mutual Influence/Coupling Term):**
  - $\beta_A$ : Represents how Party B's trust in A ( $T_B$ ) influences Party A's trust in B ( $T_A$ ). A positive  $\beta_A$  indicates that as B's trust in A increases, A's trust in B is also positively influenced. This is the direct "coupling" of trust.
  - $\beta_B$ : Similarly, represents how Party A's trust in B ( $T_A$ ) influences Party B's trust in A ( $T_B$ ).
  - These terms are crucial for modeling reciprocity and the feedback loops inherent in GRIT.
- **$\gamma_i T_i$  (Natural Decay/Growth Rate):**
  - $\gamma_A, \gamma_B$ : Linear coefficients representing the intrinsic rate at which trust decays (if negative, reflecting inherent skepticism or default distrust) or grows (if positive, reflecting a default towards cooperation in the absence of other factors).
- **$\delta_i I_i(t)$  (Impact of GRIT Initiatives/Reciprocity):**
  - $I_A(t)$ : Represents Party A's GRIT initiative (e.g., a specific cooperative action). This would be a time-dependent "forcing function" or pulse, reflecting Osgood's "unilateral initiative."

- $IB(t)$ : Represents Party B's reciprocation to A's initiative.
- $\delta_A, \delta_B$ : Coefficients quantifying the sensitivity of trust to these initiatives.
- **Crucially, the "Logic of Not" enters here:** The *perceived impact* of  $IA(t)$  on  $TB$ , and  $IB(t)$  on  $TA$ , is not a simple binary activation. An initiative  $IA(t)$  might be perceived by B not as a clear "1" (total trust-building act) but as some value reflecting "not entirely trustworthy but not entirely deceptive," based on historical context and current suspicions. This perception could be modeled by a fuzzy or neutrosophic function applied to  $IA(t)$  before it influences  $dTB/dt$ . For example,  $\delta_B IA(t)$  might become  $\delta_B \cdot \text{Perception}(IA(t), \text{History}_B, \text{LogicOfNot})$ , where Perception maps  $IA(t)$  to a nuanced value based on B's current "not-state" of trust.
- **$\epsilon S(t)$  (Impact of External Shocks/Systemic Factors):**
  - $S(t)$ : Represents external, systemic events (e.g., global crises, third-party mediation efforts, unexpected provocations, changes in leadership). These can be positive or negative.
  - $\epsilon_A, \epsilon_B$ : Coefficients for sensitivity to these external factors. This acknowledges that trust dynamics don't occur in a vacuum.

**Dynamics of GRIT within the Model:** GRIT aims to shift the system from a low or negative trust equilibrium (where the equations balance at low  $TA, TB$ ) to a higher trust equilibrium. The unilateral initiatives ( $IA(t)$ ) act as targeted perturbations. If Party B's "Logic of Not" perception of  $IA(t)$  is sufficiently positive (i.e., it's interpreted as "not not-cooperative"), it will increase  $TB$ . This increase in  $TB$ , through the  $\beta ATB$  term, then positively influences  $TA$ , initiating the spiral of trust. The non-linear  $\alpha$  terms help reinforce this spiral, potentially leading to a new, stable high-trust equilibrium. Conversely, a misinterpreted initiative or a strong negative external shock ( $S(t)$ ) could send the system spiraling back into distrust.

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## 6. The Intertwined Nature of Trust Dynamics in the Model

The Borromean model of intertwined humanity provides a crucial conceptual underpinning for the coupled Riccati ODEs. While the ODEs explicitly show the coupling between Party A's and Party B's trust, the Borromean analogy implies a deeper, often unseen, third element that maintains the entire structure of the conflict or enables its resolution.

- **Borromean Interpretation of Coupling:** Beyond the direct  $TA \leftrightarrow TB$  coupling, consider a third, often implicit, factor that enables the conflict's persistence or its resolution. This might be a shared vulnerability (e.g., climate change), a historical grievance that binds them in animosity, or a crucial mediating institution that holds the process together. In a Borromean sense, the entire trust-building dynamic (represented by  $TA$ ,  $TB$ , and this third factor,  $X$ ) is only maintained as a cohesive system as long as all three are present and intertwined. If Party A's willingness to trust ( $TA$ ) falters, it doesn't just reduce  $TB$ ; it might destabilize the underlying, implicit "Borromean bond" that was holding the entire conflict/resolution system together, causing it to unravel. This suggests that the coefficients  $(\alpha, \beta, \gamma)$  in the Riccati equations are not static but are themselves context-dependent and influenced by these underlying, Borromean-like systemic factors.
- **Neutrosophic Indeterminacy in Parameters:** Our prior work highlighted Neutrosophic Complete Graphs as a way to represent the indeterminacy in real-world systems. Extending this to the model, the parameters of the Riccati ODEs  $(\alpha, \beta, \gamma, \delta, \epsilon)$  should not be seen as fixed, crisp values. Instead, they could be **neutrosophic numbers**, where each parameter is defined by a degree of truth, indeterminacy, and falsity regarding its influence. For example, the impact coefficient  $\delta_A$  for Party A's initiative on Party B's trust might not be a precise 0.5, but "neutrosophically 0.5," meaning there's a degree of certainty about its value, but also an inherent degree of indeterminacy due to unforeseen psychological factors or external events. This allows the model to reflect the profound uncertainty inherent in predicting human responses in conflict.
- **Ubuntu's Influence on Model Outcome:** The ultimate goal of GRIT, aligned with Ubuntu philosophy, is not just the absence of conflict but a state of mutual well-

being and shared flourishing. In the context of the Riccati model, this means that the desired "solution" or stable equilibrium is one where TA and TB both reach high, positive values, reflecting a state where "I am because we are" in trust. The parameters of the ODEs, implicitly or explicitly, could be tuned (e.g., through policy decisions reflecting Ubuntu principles) to guide the system towards such a collectively beneficial, high-trust equilibrium. The model thus becomes a tool to explore pathways to shared humanity, not just conflict avoidance.

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## 7. Challenges and Future Directions

While this conceptual model offers a rich framework, its practical application and further development face significant challenges:

- **Parameter Estimation and Empirical Validation:** The most formidable challenge is empirically determining the values of the Riccati parameters ( $\alpha, \beta, \gamma, \delta, \epsilon$ ) from real-world conflict data. This would require extensive qualitative and quantitative data analysis, potentially involving content analysis of diplomatic communications, surveys of public opinion, or statistical analysis of conflict events. Agent-based modeling, where individual actors with "Logic of Not" perceptions interact, could also inform parameter ranges.
- **Mathematical Formalization of "Logic of Not" in ODEs:** Integrating the nuanced perception offered by Nagatomo's "Logic of Not" into continuous differential equations is mathematically complex. It might necessitate the use of fuzzy differential equations, stochastic differential equations (where uncertainty is modeled as noise), or hybrid systems that combine continuous dynamics with discrete, "logic-based" decision points or perception functions. Representing neutrosophic parameters in a solvable ODE system would also require advanced mathematical techniques.
- **Complexities of Multi-Party Conflicts:** Most real-world conflicts involve more than two parties. Extending this coupled two-equation model to N-parties would dramatically increase complexity, requiring  $(N(N-1))/2$  trust variables and

potentially leading to more intricate Borromean structures that are harder to represent.

- **Dynamic Nature of Parameters:** In reality, the parameters themselves ( $\alpha, \beta$ , etc.) are not static but evolve over time based on learning, shifts in ideology, or changes in leadership. Modeling these as dynamic variables or fuzzy sets would add another layer of complexity.
- **Connecting Initiatives to Perceived Trust:** A key area for further research is how specific GRIT initiatives (e.g., troop withdrawal, economic aid, public apology) translate into the effective "input" terms ( $IA(t)$  and  $IB(t)$ ) in the ODEs, especially when filtered through the "Logic of Not" perception functions. This would require deep insights from psychology, sociology, and political science.
- **Policy Implications:** If such a model could be refined and calibrated, it would offer invaluable insights for policymakers. It could help identify critical thresholds for trust, predict the impact of different sizes or types of GRIT initiatives, and determine optimal timing for interventions to shift conflict dynamics towards peace.

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## 8. Conclusion: From Intertwined Humanity to Actionable Peace

The vision of "intertwined humanity," articulated through Neutrosophic Complete Graphs, Ubuntu, and the profound implications of Borromean rings and Nagatomo's "Logic of Not," offers a powerful and comprehensive lens through which to re-examine the dynamics of conflict and peace-building. By applying this framework to GRIT, we move beyond simplistic, linear models of trust building to embrace the inherent complexity, non-linearity, and perceptual nuances that characterize real-world human interactions.

Our proposed conceptual model, utilizing coupled Riccati Ordinary Differential Equations, provides a plausible mathematical structure for representing the interdependent and self-reinforcing nature of mutual trust. It explicitly accounts for the critical role of reciprocity, external influences, and the crucial interpretation of

initiatives through a non-binary "Logic of Not" lens. The Borromean analogy further underscores that peace, like human existence, is not reducible to independent parts but emerges from a transformed, irreducibly linked whole.

While this remains a conceptual model, requiring extensive future research for empirical validation and mathematical formalization, it illuminates a promising avenue for transdisciplinary inquiry. By integrating insights from philosophy, logic, psychology, and mathematics, we can develop more sophisticated tools to understand the intricate dance of trust and distrust in conflict. Ultimately, by recognizing the "intertwined humanity" that binds us, even in our moments of deepest conflict, we move closer to formulating strategies that lead to not just the cessation of hostilities, but to a more stable, compassionate, and shared future for all.

Version 1.0: 2 jul 2025, pk. 17:25

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