Title: Recursive Influence Dynamics (RID): A New Strategic Framework for Advanced Behavioral Modeling

Abstract: Recursive Influence Dynamics (RID) is a novel theory that transcends traditional Game Theory by embedding psychological, hierarchical, and recursive feedback mechanisms into strategic decision modeling. It introduces multi-dimensional influence tracking, dominance flow mapping, and recursive behavioral anticipation to better predict agent interactions in complex environments. This white paper defines the RID framework, formalizes its components mathematically, and provides a real-world use case in real estate negotiations.

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1. Introduction Game Theory has long served as the cornerstone for strategic decision-making among rational agents. However, real-world decisions often involve irrational behavior, shifting perceptions, recursive expectations, and social dominance cues. RID offers a refined lens that builds on Game Theory's foundation to better model these multi-layered dynamics.

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2. Core Tenets of Recursive Influence Dynamics

2.1 **Influence Quotient (IQ)**
Each agent A_i is assigned an Influence Quotient IQ_i , representing their ability to affect other agents' decisions in a given context.

2.2 **Recursive Strategic Anticipation (RSA)**
Each agent builds a multi-order model of what other agents believe they (and others) will do:

RSA_i^k = model of agent A_i's belief at recursion depth k

2.3 **Dominance Vectors (DV)**
A vector DV_ij defines the relative dominance A_i exerts over A_j. These evolve through interactions and recursive updates.

2.4 **Perceptual Drift (PD)**
Belief systems are not static. PD_i(t) models how agent A_i's perceptions of the system shift over time.

2.5 **Behavioral Echoes (BE)**
Decisions are path-dependent. BE_i(t) maps historical choices and their recursive weight on current influence and strategy.

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3. Mathematical Framework

Let:

- G = (A, S, T), a recursive influence game with agents A = {A_1, A_2, ..., A_n}, state space S, and time T
- IQ: A 192 [0,1], Influence Quotient function
- RSA_i^k: k-level strategic anticipation function
- DV: A 0d7 A 192 [-1,1], Dominance Vector field
- PD_i: T 192 11d^n, Perceptual Drift function over time
- BE_i: T 192 11d, Behavioral Echo memory weighting

Then, the effective strategy S_i^* for agent A_i is defined recursively as:

$$S_i^*(t) = f(IQ_i, RSA_i^k(t), DV_{ij}(t), PD_i(t), BE_i(t))$$

Where f is an agent-specific behavioral synthesis function.

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4. Use Case: Real Estate Negotiation Simulation

Scenario: Agent RJ is negotiating with a landowner and a builder. Traditional Game Theory would model this as a payoff matrix. RID goes deeper.

Agent Setup:

- RJ (developer): IQ = 0.85
- Landowner: IQ = 0.6
- Builder: IQ = 0.7

Dominance Vectors:

- DV_RJ,LO = +0.4 (RJ is seen as more dominant by landowner)
- DV_RJ,B = -0.1 (Builder sees RJ as slightly less dominant)

Perceptual Drift:

- Builder's view of RJ shifts positively after offer flexibility (PD_B increases)

Behavioral Echo:

- Past overpromising by builder affects RJ's trust (BE_RJ negative weight applied)

Pseudocode Simulation:

```
agents = {"RJ": 0.85, "Landowner": 0.6, "Builder": 0.7}
dominance = {("RJ", "Landowner"): 0.4, ("RJ", "Builder"): -0.1}
perceptual_drift = {"Builder": lambda t: 0.05 * t}  # builder warms up
behavioral_echo = {"RJ": lambda t: -0.2 if t < 3 else 0}
```

```
for t in range(1, 6):
    RJ_trust = 0.5 + perceptual_drift["Builder"](t) +
behavioral_echo["RJ"](t)
    print(f"Time {t}: RJ strategic trust level in Builder = {RJ_trust:.2f}")
```

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5. Applications of RID

- **Real Estate:** Predict negotiation pivots, dominance perception shifts, and trust decay
- **Military Wargames:** Track recursive psychological tactics
- **Market Influence Modeling:** Analyze investor or consumer herd behavior across time layers
- **Diplomatic Strategy:** Model recursive misdirection, perception management, and strategic ambiguity

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6. Conclusion Recursive Influence Dynamics is not merely a refinement of Game Theory; it's a paradigm shift. By encoding influence, perception, and behavioral recursion into strategic modeling, RID enables a more realistic, powerful, and predictive framework for modern complex systems.
