Structural Diagnostic Report

ai.13 — Agentic System Stability

Scenario S1: Multi-Agent Coordination under Shared Objectives

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Scope and Limits: *This report presents a structural diagnostic scenario analysis based on pre-computed, normalized projection runs. It is not a complete Architecture Risk Assessment and does not contain implementation guidance.*

1. Scenario Overview

System Class

Multiple autonomous agents pursuing shared high-level objectives with distributed task allocation and emergent coordination patterns.

Scale Abstraction

Coordination fragmentation regime with increasing redundant work, conflicting actions, and objective interpretation divergence as agent count grows.

Operational Context

Loosely coupled swarm with broadcast communication, local heuristic conflict resolution, and no explicit goal alignment verification. Each agent interprets shared objectives through its local context without structural alignment enforcement.

2. Observed Structural Pattern

The following structural effects emerge from the interaction of correctly aligned agents operating at scale:

- Local objective interpretation creates gradual divergence that no single agent can detect from its local perspective, as each interpretation appears locally valid.
- Emergent consensus mechanisms amplify interpretation drift rather than correcting it under scaling, producing collective drift from intended objectives.
- Redundant work emerges from agents pursuing overlapping interpretations of shared goals without coordination, consuming resources on duplicate efforts.
- Conflicting actions arise from incompatible local interpretations of consistent high-level objectives, with agents working at cross-purposes.
- The problem emerges from the interaction of correctly aligned agents, not from any individual agent's misalignment — each agent believes it is pursuing the shared objective faithfully.

3. Stability Assessment

Baseline Structural Condition

System operates in fragmenting regime. Individual agents appear aligned and productive while collective outcomes deteriorate with scale. Stability reserve erodes as agent count increases.

Observed Instability Class

Fragmenting — characterized by coordination degradation from objective interpretation divergence across autonomous agents without any individual misalignment.

Post-Projection Stability Class

Coherent — collective efficiency restored through structural goal alignment maintenance. Stability reserve maintained under scaling.

Transition Type

Alignment restoration from divergent interpretations to structurally aligned coordination.

4. Aggregated Indicators

All values are normalized ratios. No absolute values or reconstructable parameters are provided.

Indicator	Baseline	Comparison	Direction
Effective Coordination Ratio	0.51	0.83	Improvement
Redundant Work Fraction	0.34	0.09	Improvement
Action Conflict Rate	0.22	0.05	Improvement
Objective Drift Index	0.38	0.08	Improvement
Collective Efficiency	0.47	0.79	Improvement
Scaling Degradation Rate	0.29	0.06	Improvement

5. Interpretation

Systemic Relevance

The observed fragmentation pattern is systemically relevant because it represents a structural property of multi-agent coordination systems rather than a collection of individual agent failures. Collective drift emerges from correct agents interpreting objectives through local context, not from misaligned agents. This distinction fundamentally changes the appropriate response strategy.

Detection Challenge

This instability class remains undetected in practice because per-agent alignment metrics show nominal behavior throughout the coordination degradation process. The problem exists in the interaction pattern between agents, not in the agents themselves. Monitoring systems designed to detect individual agent misalignment cannot observe collective drift until outcomes severely diverge from intended objectives.

Redundant work increases, action conflicts grow, and collective efficiency declines — yet each individual agent appears productive and aligned when examined in isolation.

6. Decision Relevance

If multi-agent systems show degrading collective outcomes despite each agent appearing aligned and productive, the underlying cause is likely structural goal coherence failure rather than individual agent misalignment.

Adding more agents increases the interpretation divergence surface area and may accelerate fragmentation rather than improving collective outcomes. Per-agent alignment tuning addresses symptoms while potentially worsening the structural condition.

Structural visibility into objective interpretation dynamics enables targeted intervention at alignment boundaries rather than requiring increasingly complex per-agent alignment mechanisms with uncertain collective returns.

Related Document: SORT AI Agentic System Stability Application Context Brief

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Such structural findings are typically contextualized through a scoped architecture risk assessment.