Control-Entangled Abstract Nodes: A Model of Non-Local, Reconfigurable Control Systems

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Abstract

This paper presents an abstract model of nodes conceived as spaces bounded by conceptual boundaries, each capable of containing control units ("switches"). These nodes are linked via control relationships that are non-local, allowing their connectivity and influence to transcend spatial or dimensional constraints. A master node with an internal, self-regulating control unit modulates the state of entangled nodes equipped with external, reactive switches. The model emphasizes the parallel arrangement of nodes, the reconfigurability of control pathways, and the abstraction of boundaries and spaces as probabilistic containers of potential. This framework offers a versatile foundation for understanding distributed agency, synchronization without locality, and dynamic control topologies across multiple disciplines, from systems theory and cognition to metaphysics and network science.

1. Introduction

The conceptualization of control and influence across distributed systems traditionally depends on spatial proximity or physical connections. However, in complex systems—whether quantum, cognitive, or cybernetic—the notion of locality often fails to capture the underlying non-local relationships that govern state changes and synchronization. Here, we propose a model where nodes are not physical entities but abstract spaces bounded conceptually, linked by control mechanisms independent of spatial constraints.

The fundamental insight is that the connectivity of these nodes is defined by control logic rather than physical adjacency. This non-local entanglement of nodes allows for dynamic, reconfigurable networks where control can be centralized, distributed, or hybridized, enabling a rich topology of agency and responsiveness.

2. Model Description

2.1 Nodes as Abstract Spaces

Nodes represent bounded spaces of potential – probabilistic containers that may or may not harbor a control unit. The boundaries, while abstracted away in this core model, conceptually signify energy levels or activation thresholds, framing the capacity of each node to embody agency or remain passive.

2.2 Control Units ("Switches")

Control within the system is mediated by switches, which toggle node states based on passing signals such as data, energy, or symbolic inputs. Switches are categorized as follows:

Internal Switch (Master Control): Located inside a node, this switch is self-regulating and selective, determining when to initiate or block signals to linked nodes. It embodies autonomous agency.

External Switches: Positioned outside individual nodes, these switches are reactive. They respond to incoming signals by toggling states but lack intrinsic selectivity.

2.3 Entanglement and Non-Local Control

Nodes are linked through control entanglement, a relational topology that is independent of spatial arrangement. This configuration supports parallelism, where multiple nodes can be influenced simultaneously by the master control, and allows flexible rearrangement of nodes and control pathways without loss of function.

3. Discussion

The model abstracts away from physicality, focusing on control relationships and potentiality within bounded spaces. It mirrors phenomena in quantum mechanics, where entangled particles maintain correlated states regardless of distance, and cognitive systems, where distributed mental processes interact without strict locality.

The ability to reconfigure control links arbitrarily suggests applications in modular system design, adaptive network architectures, and metaphysical frameworks that treat agency as a non-local, relational property.

Furthermore, this abstraction invites exploration of dynamics, where nodes can transition from reactive to autonomous by acquiring internal switches, and where control signals fluctuate to simulate activation thresholds or energy boundaries.

4. Conclusion

This paper introduces a conceptual framework of control-entangled abstract nodes, offering a versatile language to describe non-local, reconfigurable control systems. By decoupling agency and influence from spatial constraints, the model provides a foundation for exploring distributed control across scientific, philosophical, and computational domains.