Mechanism and Implementation Strategies of Intelligence Symbiosis: Postprint

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Abstract

[Purpose/Significance] Intelligence generation theory interprets individual intelligence cognition issues. Intelligence symbiosis research then directs intelligence cognition studies toward the perspective of knowledge community intelligence cognition, aiming to provide a more comprehensive and appropriate interpretation of intelligence cognition theory and practice. [Method/Process] Based on an understanding of symbiosis theory and comprehension of the "symbiosis" connotation embedded in the "multi-angle representation" stage of intelligence cognition research, this study employs an integrated multi-disciplinary theoretical research approach and mathematical modeling methods to investigate the mechanisms of intelligence symbiosis and formulate corresponding implementation strategies. [Results/Conclusions] This work establishes the concept of intelligence symbiosis; elucidates its four elements, revealing its macroscopic self-organizing characteristics and the microscopic feature of multi-variable interactions generating intelligence symbiosis energy; analyzes the dynamic evolution process of the intelligence symbiosis system triggered by phase transitions in intelligence symbiosis patterns and the logistics growth law governing it; expounds on the value of research into intelligence symbiosis mechanisms from multiple perspectives including Marxist philosophy; and formulates implementation strategies for intelligence symbiosis premised on element optimization and variable enhancement. These research results demonstrate that intelligence symbiosis is an asymmetrically reciprocal intelligence cognition process completed through communication and interaction via specific interfaces by an intelligence cognition community in an open environment, and that it plays a leading role in intelligence cognition practice.

Full Text

Preamble

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Research on the Mechanism and Implementation Strategies of Intelligence Symbiosis

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Abstract

[**Purpose/Significance**] The theory of intelligence generating explains individual intelligence cognition problems. Intelligence symbiosis research extends intelligence cognition studies to the perspective of knowledge community intelligence cognition, aiming to provide a more comprehensive and appropriate interpretation of intelligence cognition theory and practice. [**Method/Process**] Based on an understanding of symbiosis theory and the "symbiosis" implications embedded in the "poly-angle expressing" stage of intelligence cognition research, this study employs multidisciplinary theoretical integration and mathematical modeling methods to investigate the mechanism of intelligence symbiosis and formulate corresponding implementation strategies. [**Result/Conclusion**] The concept of intelligence symbiosis is established; its four key elements are elaborated; characteristics of self-organization at the macro level and multi-variable interaction generating intelligence symbiosis energy at the micro level are revealed. The dynamic process of intelligence symbiosis system evolution triggered by phase transformation of intelligence symbiosis patterns and the logistics growth law followed therein are analyzed. The value of intelligence symbiosis mechanism research is expounded from multiple perspectives including Marxist philosophy. Implementation strategies for intelligence symbiosis are formulated based on element optimization and variable enhancement. These findings demonstrate that intelligence symbiosis is an asymmetrically reciprocal intelligence cognition process completed by an intelligence cognition community through interactive communication via specific interfaces in an open environment, which guides intelligence cognition practice.

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"Where does intelligence come from?" is the core proposition of intelligence cognition research. Based on traditional intelligence cognition perspectives, the theory of intelligence generating explains individual intelligence cognition problems. However, given that traditional intelligence cognition perspectives "psychologize

epistemological issues, studying knowledge through individuals rather than examining psychological problems from an epistemological standpoint, and observing individual knowledge from historical, cultural, and social perspectives," they consequently "lack the complete paradigm characteristics required by paradigm theory." In the big data era, the vastness of information and the complexity of cutting-edge science place higher demands on individual intelligence cognition capabilities. Any slight deficiency may cause individuals relying solely on their own strength to fall into the dilemma of "information blind spots" and "knowledge misconceptions" when generating forward-looking, strategic, and competitive intelligence, making the goal of achieving "high-end, precise, and in-depth" intelligence cognition practice a mere illusion. This paper employs symbiosis theory to study the mechanism and implementation strategies of intelligence symbiosis, answering how a community composed of intelligence workers and intelligence users overcomes these dilemmas, thereby advancing the exploration of the core proposition "where does intelligence come from."

2. Related Research Status

2.1 Symbiosis Theory

The concept of symbiosis represents an ancient human orientation. The wisdom of "unity of heaven and man" embedded in "Heaven and earth coexist with me, and all things are one with me" (*Zhuangzi · Equality of Things*) is deeply rooted in the genetic sequence of ancient Chinese culture. The term "symbiosis," derived from the Greek "sumbioein" meaning "living together," was defined by A. de Bary in 1879 as "different species living together." Since then, biologists have pursued two directions in natural symbiosis research: micro-level cellular and molecular symbiosis, and macro-level biosphere ecological cycle symbiosis, forming profound theoretical abstractions and rich empirical results regarding this "one of the ten greatest creations in the living world."

In the mid-19th century, Marx applied symbiotic logic to understand things, people, and society, stating that "if a being is not an object for a third party, it has no object as its own, meaning it has no objective relationship, and its existence is not objective existence." A century later, symbiosis thinking was comprehensively integrated into philosophical and social science research. Theoretically, Shumon Ozawa philosophically distinguished between "commonality" and "symbiosis," arguing that the latter is "premised on heterogeneity; precisely because parties differ in values, norms, and goals can they establish a 'mutual survival' relationship." Wu Feichi noted that "humans have intersubjectivity due to symbiotic coexistence; when I exist as myself, others also exist as themselves, with 'I' and 'other' mutually dependent and freely coexisting." Hu Shoujun and Yuan Chunqing respectively proposed and constructed analytical frameworks and general analytical paths for social symbiosis. Practically, M.R. Chertow argued that the vision of a new industrial development concept—the "industrial ecosystem"—and the emergence of industrial symbiosis signs in Kalundborg, Denmark, became the catalyst for industrial symbiosis theory and

its implementation. Xia Liping pointed out that China's "Belt and Road" initiative aims to build a community of shared interests, destiny, and responsibility with countries along the Silk Road, with the long-term goal of establishing a symbiotic international system.

Tracing over a century of symbiosis research, from biological symbiosis to ecological symbiosis to social symbiosis, scholars have not only depicted a picture of symbiotic prosperity and co-evolution in nature but also established new concepts and action guidelines for win-win cooperation and sustainable development in human society through the creation of symbiosis philosophy and methodology, along with numerous successful social symbiosis practice examples. However, existing research predominantly focuses on symbiotic evolution of social organizations, symbiotic development in technology and industrial fields, and symbiosis analysis of financial systems, with few deep connections to intelligence cognition research—providing an opportunity for original innovation in intelligence symbiosis research.

2.2 Intelligence Cognition Research

Since its inception, information science has undergone a paradigm shift from the institutional paradigm to the movement paradigm. As the movement paradigm's research orientation shifted from systems to people, the core concept of intelligence cognition research was formed: "Any information processing, whether perceptual or symbolic, is conducted through a system of categories or concepts that constitute the world model of the information processor (such as humans)."

P. Ingwersen divided intelligence cognition research into two stages. Before 1992, the "first stage" represented by B.C. Brookes's basic equation of informatics highlighted characteristics of subjective idealism, rationalism, empiricism, and individualism methodology. By understanding isolated users' intelligence needs and internal psychological activities, it achieved "user and media-oriented" intelligence analysis, establishing the dominance of cognitive views over system views in intelligence science research. However, these studies were criticized for heavy psychological imprints and lack of social dimensions. Since 1992, intelligence cognition research has entered the "poly-angle expressing" stage, represented by social cognition views, B. Hjørland's domain analysis, and P. Ingwersen's cognitive work analysis, which "adopts a comprehensive perspective to observe all interactive communication processes occurring in information transmission."

Social cognition views focus on individual cognition from a social rather than "isolated mind or brain" perspective, operating not from inside-out but from outside-in. They emphasize that individuals must use shared meaning structures maintained by society or groups to construct meaning in different contexts and revise their own conceptual structures. Macro intelligence cognition views "take society or groups as the background, rely on specific disciplinary or domain knowledge, center on specific tasks, and comprehensively consider all factors,

bridging the gap between the cognitive school and intelligence science practice."

The "poly-angle expressing" stage of intelligence cognition research follows scientific realism, social structuralism, and holistic methodology. Its advocacy of "replacing isolated minds and brains with social perspectives" and analytical methods of "outside-in" and "constructing meaning in different contexts" demonstrate symbiosis implications, reflecting the symbiosis philosophical kernel of coexistence, mutual progress, and win-win cooperation, forming convergence points with symbiosis theory and becoming the foundation for multi-dimensional innovation in intelligence symbiosis research.

3. Mechanism of Intelligence Symbiosis

The intervention of symbiosis theory opens a new chapter in intelligence cognition research. Intelligence symbiosis refers to the relationship formed by intelligence symbiosis units in a certain intelligence symbiosis environment through a certain intelligence symbiosis interface according to a certain intelligence symbiosis pattern. Specifically, this is an objective social phenomenon: two heterogeneous knowledge populations (intelligence workers and intelligence users) in a knowledge community form an intelligence cognition community to complete intelligence cognition practice.

3.1 Elements of Intelligence Symbiosis

Based on the concept of intelligence symbiosis, its elements include symbiosis units, symbiosis interface, symbiosis environment, and symbiosis pattern.

3.1.1 Intelligence Symbiosis Units Intelligence symbiosis units are the basic units constituting intelligence symbiosis relationships, composed of intelligence workers and intelligence users. Taking a subject service team for a specific research project as an example, the former includes subject librarians and support librarians from the library, while the latter includes the project leader and participants. These are heterogeneous symbiosis units, with their symbiotic relationship reflected through different variables, the most important being quality parameters reflecting their intrinsic properties. Assuming the quality parameters of intelligence workers (W) and intelligence users (U) are Z_w and Z_u respectively, with quality parameter sets Z_w = {Z_{w1}, Z_{w2}, Z_{w3}, … Z_{wk}} and Z_u = {Z_{u1}, Z_{u2}, Z_{u3}, … Z_{ui}}, if at least one of the following exists: Z_{wi} = ϕ{Z_{uj}} or Z_{ui} = ϕ{Z_{wj}}, then the quality parameters of both parties are compatible and mutually expressive, demonstrating a symbiotic relationship. Specifically: (1) Both show causal compatibility in intelligence supply-demand quality parameters—the former achieves knowledge service value by providing intelligence, while the latter needs intelligence to solve practical problems; (2) Both demonstrate complementary advantages of information management and knowledge transformation quality parameters in the intelligence symbiosis process.

Additionally, major variables affecting their symbiotic relationship include symbiosis dimension, correlation degree, symbiosis degree, and information abundance. These four variables respectively reflect the number of types in a given space, the number of quality parameters, the degree of mutual influence, and the degree of information possession between the two parties. Enhancing these variables will facilitate the formation and maintenance of their symbiotic relationship.

3.1.2 Intelligence Symbiosis Interface The intelligence symbiosis interface is the sum of contact methods and mechanisms between intelligence workers and intelligence users in intelligence symbiosis, serving as the medium, channel, and carrier for spiritual and material (substance, information, and energy) conduction between the two parties. The interface consists of a set of symbiosis media. In addition to value-level media such as the intelligence symbiosis concept upheld by both parties, it mainly includes: (1) Each party's information retrieval strategies, information organization and analysis methods, knowledge structures, cognitive programs (logical thinking habits), specific logical thinking states, mentalities (psychological qualities), and behavioral norms; (2) Various documentary information resources and communication platforms, as well as "belief systems" with commensurability and social-historical attributes within academic communities. It is precisely the direct or indirect role of these tangible and intangible symbiosis media that continuously changes the interface characteristic coefficient λ [0, $+\infty$], the intelligence symbiosis energy asymmetric distribution factor α [-1, 0], and the distribution selection coefficient β [1, ∞] of the intelligence symbiosis interface, making the symbiosis interface between the two parties smoother, the symbiosis energy distribution more reasonable, and the interaction dynamics greater than resistance, thereby forming and maintaining the symbiosis relationship.

3.1.3 Intelligence Symbiosis Environment The intelligence symbiosis environment is the spatiotemporal normality in which intelligence workers and intelligence users form an intelligence symbiosis entity, including social and economic development levels, regulatory policy control intensity, cultural construction and communication standards, scientific and technological resource allocation scales, and professional and living atmospheres. Through regular interactions, this spatiotemporal normality exerts three dynamic influences on the formation and evolution of the intelligence symbiosis entity: either incentive and positive effects; or neither positive nor negative effects; or inhibitory and negative effects. An excellent intelligence symbiosis environment can ensure stable structure, optimal function, and maximum benefits of the intelligence symbiosis entity.

3.1.4 Intelligence Symbiosis Pattern The intelligence symbiosis pattern is the mode of interaction or combination between intelligence workers and intelligence users, reflecting the intensity and level of material, information, and

energy exchange between them. Theoretically, symbiosis patterns are divided into four behavioral patterns and four organizational patterns, with their pairwise combinations reflecting 16 symbiosis system states. However, regarding intelligence symbiosis patterns, the symmetric reciprocal symbiosis behavioral pattern and the integrated symbiosis organizational pattern are excluded due to their overly absolute characteristics; the point symbiosis and intermittent symbiosis organizational patterns are excluded due to unstable interfaces and low specificity; and the parasitic and commensal symbiosis behavioral patterns are excluded because they only benefit intelligence users' self-development and have minimal probability of existence. The continuous symbiosis organizational pattern enables intelligence workers and intelligence users to continuously and multi-directionally interact through a stable symbiosis interface in specific spatiotemporal normality, forming a relatively stable and specific symbiotic relationship. The asymmetric reciprocal symbiosis behavioral pattern generates intelligence symbiosis energy and forms a reasonable asymmetric broad-spectrum distribution between the two parties, maintaining their symbiotic relationship. Therefore, the combination of continuous symbiosis organizational pattern and asymmetric reciprocal symbiosis behavioral pattern constitutes the continuous asymmetric reciprocal symbiosis pattern—the ideal pattern of intelligence symbiosis that presents an ideal state of the intelligence symbiosis system.

3.2 Characteristics of Intelligence Symbiosis

3.2.1 Macro Characteristics At the macro level, intelligence symbiosis exhibits self-organization, possessing dissipative structure and synergetics characteristics: (1) Intelligence symbiosis units are both independent and interrelated. Intelligence symbiosis is not legally binding social behavior. The heterogeneity of intelligence symbiosis units means they develop independently and freely in their respective disciplinary fields and research orientations. However, once the two parties form an intelligence symbiosis relationship due to causal compatibility in intelligence supply-demand quality parameters, they inevitably form an interdependent knowledge community. (2) Intelligence symbiosis is open and irreversible. Openness enables continuous interaction between intelligence symbiosis units, between units and interfaces, and between the symbiosis entity and environment, introducing negative entropy and enhancing the orderliness of intelligence symbiosis. Any evolution of an intelligence symbiosis system manifests as a function of specific spatiotemporal conditions and related variables; time is irreversible, and thus the evolution of intelligence symbiosis systems is irreversible. (3) Intelligence symbiosis demonstrates nonlinearity and non-equilibrium. Only nonlinearity can ensure the independence and interactive association of intelligence symbiosis units, while non-equilibrium is reflected in phase transformations of intelligence symbiosis patterns. Parasitic and commensal patterns, due to non-broad-spectrum distribution of intelligence symbiosis energy—that is, deviation of the asymmetric distribution factor α at critical points—cause fluctuation phenomena, making phase transformation toward more ordered continuous asymmetric reciprocal patterns inevitable. (4)

Intelligence symbiosis presents synergistic effects. First, intelligence symbiosis units are dominated by their quality parameters. Whether quality parameters are compatible and how they are compatible determines whether a symbiotic relationship can form and what pattern it will adopt. Once the symbiotic relationship is established and the ideal continuous asymmetric reciprocal symbiosis pattern is adopted, the symbiosis degree reflected by the quality parameters of the units will be enhanced. Second, intelligence symbiosis is a cooperative, coprogressive, and sharing intelligence cognition practice among units, which does not exclude "positive-sum competition" between them—often becoming a new driving force for this practice.

3.2.2 Micro Characteristics Micro characteristics of intelligence symbiosis are embodied in symbiosis dynamics. The intelligence symbiosis process generates new net energy—intelligence symbiosis energy E—expressible through the intelligence symbiosis energy function:

$$E = f(Z_w, Z_u, \theta_{wu}, \theta_{uw}, \zeta_{wu}, \zeta_{uw}, \delta_{wu}, \delta_{uw}, \lambda, S, F)$$

where: Z_w and Z_u, _{wu} and _{uw}, _{wu} and _{uw}, δ{wu} *and* δ{uw} are respectively the quality parameter sets, symbiosis coefficients, symbiosis dimensions, and symbiosis degrees of intelligence symbiosis units; λ, S, and F are respectively the symbiosis interface characteristic coefficient, adopted symbiosis pattern, and faced symbiosis environment of the units. This means intelligence symbiosis energy results from the interaction of these variables, with δ{wu} *and* δ{uw} and λ being the decisive variables. The larger they are, the closer the association between the two parties and the smaller the interaction resistance, resulting in greater intelligence symbiosis energy.

3.3 Evolution of Intelligence Symbiosis System

3.3.1 Evolution Process of Intelligence Symbiosis System If intelligence workers and intelligence users do not form a symbiotic relationship, their intelligence cognition practice adopts a parallel mode, as shown in Figure 1 [Figure 1: see original paper].

Figure 1 shows that the parallel mode means intelligence workers and intelligence users complete intelligence cognition practice using their respective "isolated minds or brains." However, when the former interrupts the knowledge transformation link due to deficiencies in knowledge structure and cognitive programs, resulting in "knowledge misconceptions," intelligence cognition practice becomes unsustainable. When the latter fails in information retrieval due to deficiencies in information retrieval strategies and information organization/analysis methods, resulting in "information blind spots," intelligence cognition practice cannot even begin.

The intelligence symbiosis system is a collection of symbiotic relationships formed by intelligence workers and intelligence users according to specific

intelligence symbiosis patterns. Its state is determined by the combination of two dimensions of intelligence symbiosis patterns: organizational patterns and behavioral patterns. Its evolutionary life cycle includes formation, growth, maturity, and decline (self-renewal) stages, where formation and growth correspond to parasitic or commensal patterns, and maturity corresponds to the continuous asymmetric reciprocal symbiosis pattern. Due to fluctuations caused by deviation of the intelligence symbiosis energy asymmetric distribution factor α at critical points, phase transformation from parasitic to commensal patterns and then to continuous asymmetric reciprocal symbiosis patterns occurs, ultimately facilitating the evolution of the intelligence symbiosis system, as shown in Figure 2 [Figure 2: see original paper].

Figure 2 reveals: In parasitic mode, intelligence workers utilize their information management and knowledge transformation endowments to complete intelligence cognition practice, directly delivering intelligence to intelligence users through a few symbiosis media and one-way communication mechanisms in a relatively stable symbiosis interface, without generating intelligence symbiosis energy. Intelligence users simply enjoy the fruits of intelligence workers' cognition practice, focusing solely on self-development, which ultimately leads to dissolution of the symbiotic relationship. Commensal mode mobilizes both parties to participate in intelligence cognition practice, generating intelligence symbiosis energy through multiple media and two-way bilateral exchange mechanisms on a relatively stable interface. However, this energy is non-broad-spectrum distributed, with cognition practice fruits ultimately obtained only by intelligence users without compensation mechanisms for intelligence workers, forcing them to seek alternatives. The continuous asymmetric reciprocal symbiosis pattern similarly generates intelligence symbiosis energy through multiple media and two-way bilateral exchange mechanisms on a stable interface. Although this energy is asymmetrically and broadly distributed, both parties' final gains from intelligence cognition practice fruits are controlled within reasonable intervals determined by cooperation contracts, facilitating sustainable co-development and establishing a new normal for intelligence cognition practice.

3.3.2 Mathematical Logic of Intelligence Symbiosis System Evolution In population ecology, the Logistic growth model describes the interactive situation of a population in effective spatiotemporal conditions, and more importantly, reflects its growth law: the population grows rapidly at first, slows down after reaching a certain value, and eventually stops; when a symbiotic relationship with another population is established, they influence each other, generating new growth and ultimately reaching a new and different stable state. The mathematical logic of intelligence symbiosis system evolution follows the Logistic growth law.

Assumption 1: In intelligence symbiosis system evolution, all changes in intelligence workers (W) and intelligence users (U) are concentrated in changes in intelligence cognition advantages.

Assumption 2: X and Y represent the intelligence cognition advantages of W and U respectively, both being functions of time t; γ and σ are the natural growth rates or intrinsic growth rates of W and U's intelligence cognition advantages under ideal conditions. Under natural conditions, due to various internal and external constraints, X and Y respectively approach limiting advantages M and N; X/M and Y/N are the ratios of intelligence cognition advantages to their limiting advantages, i.e., advantage growth saturation; (1 - X/M) and (1 - Y/N) are the self-inhibitions of advantage natural growth saturation on their own intelligence cognition advantages, reflecting the degree of further advantage growth. is the contribution of U's advantage growth saturation to U's intelligence cognition advantage growth, and ϕ is the contribution of W's advantage growth saturation to U's intelligence cognition advantage growth, both greater than 0. If > 1, U's promotion of W's intelligence cognition advantage exceeds W's self-inhibition, and vice versa.

(1) Parallel Mode: W and U independently conduct intelligence cognition practice using their respective endowments, with their intelligence cognition advantage growth following the Logistic growth law:

$$W: \frac{dX(t)}{dt} = \gamma X\left(1 - \frac{X}{M}\right)$$

$$U: \frac{dY(t)}{dt} = \sigma Y\left(1 - \frac{Y}{N}\right)$$

When X = M or Y = N, the Logistic coefficient becomes 0, making dX(t)/dt = 0 or dY(t)/dt = 0, forming an equilibrium stable point where W and U's intelligence cognition advantages peak. This means that if W and U do not form a symbiotic relationship, their respective intelligence cognition advantage growth will begin to decline until reaching 0.

(2) Parasitic Mode: U completely depends on W for intelligence cognition practice. W's promotion of U's intelligence cognition advantage is ϕX/M, added to equation (2):

$$W: \frac{dX(t)}{dt} = \gamma X\left(1 - \frac{X}{M}\right)$$

$$U: \frac{dY(t)}{dt} = \sigma Y\left(1 - \frac{Y}{N} + \frac{\varphi X}{M}\right)$$

The equilibrium points are: P_1[M, (1+ϕ)N], P_2(0,0). Expanding equations (3) and (4) at P(X_0,Y_0) using Taylor series and omitting quadratic and higher-order terms yields the stability condition. At equilibrium, W and U's intelligence cognition advantages are M and (1+ϕ)N > N respectively, meaning W's advantage remains unchanged while U's advantage increases under parasitic mode.

(3) Commensal Mode: Both W and U conduct intelligence cognition practice together. U compensates for W's deficiencies with broad disciplinary knowledge vision and profound academic foundation, forming a promotional effect Y/N on W's intelligence cognition advantage, added to equation (1):

$$W: \frac{dX(t)}{dt} = \gamma X\left(1 - \frac{X}{M} + \frac{\psi Y}{N}\right)$$

For U, in parasitic mode, U was completely dependent on W. Once W's intelligence cognition advantage becomes unsustainable, U's advantage inevitably declines gradually to 0: dY(t)/dt = -σY. After forming a commensal relationship, W compensates for U's deficiencies with excellent information retrieval, organization, and analysis capabilities, forming a promotional effect ϕX/M on U, added to equation (2):

$$U: \frac{dY(t)}{dt} = \sigma Y\left(-1 - \frac{Y}{N} + \frac{\varphi X}{M}\right)$$

The equilibrium points are: P_1[M(1-)/(1- ϕ), N(-1+ϕ)/(1- ϕ)], P_2(0,0). According to differential equation stability theory, P_2(0,0) is not a stable equilibrium point. When < 1, $\phi > 1$, and $\phi < 1$, P_1 is a stable equilibrium point. $<$ 1 indicates U's contribution to W's intelligence cognition advantage growth is minimal, while $\phi > 1$ indicates W's contribution to U's advantage growth is substantial. However, $\phi < 1$ requires to be very small and ϕ relatively large. M(1-)/(1- ϕ) > M shows that after forming a commensal relationship, U also promotes W's intelligence cognition advantage to some extent.

(4) Continuous Asymmetric Reciprocal Symbiosis Mode: Both W and U conduct intelligence cognition practice together. Through complementary advantages in information management and knowledge transformation, both parties' intelligence cognition advantages increase according to reasonable scales, thereby increasing overall intelligence cognition advantage, yielding the nonlinear equation system:

$$\frac{dX(t)}{dt} = \gamma X\left(1 - \frac{X}{M} + \frac{\psi Y}{N}\right)$$

$$\frac{dY(t)}{dt} = \sigma Y\left(1 - \frac{Y}{N} + \frac{\varphi X}{M}\right)$$

Linearizing this system and solving for equilibrium points yields: P_1[M(1+)/(1- ϕ), N(1+ϕ)/(1- ϕ)], P_2(0,0). Expanding at P(X_0,Y_0) using Taylor series and omitting quadratic and higher-order terms gives the coefficient matrix. According to differential equation stability theory, P_2(0,0) is not a stable equilibrium point. When $\phi < 1$, P_1 is a stable equilibrium point. Given that W and U adopt the continuous asymmetric reciprocal symbiosis mode, the stability condition

can be expressed as: < 1, $\phi < 1$, and $\neq \phi$. At equilibrium, W and U's limiting intelligence cognition advantages are M(1+)/(1- ϕ) > M and N(1+ϕ)/(1- ϕ) > N respectively, indicating that through interactive association, both parties' intelligence cognition advantages increase and stabilize.

3.4 Value of Intelligence Symbiosis Mechanism Research

Intelligence symbiosis mechanism research further strengthens the foundational position of Marxist philosophy in intelligence science research. Marx stated: "Individual A is the owner of some use value needed by individual B, and B is the owner of some use value needed by A. In this respect, natural differences create equal relationships between them… Thus they are not only in an equal relationship but also in a social relationship." He also noted: "This productive force is generated by cooperation itself. Workers in all planned joint work with others break through their personal limitations and exert their species capabilities." This research, starting from the convergence point between intelligence cognition research and symbiosis theory, treats intelligence workers and intelligence users as an intelligence cognition community with causal supply-demand association and complementary professional academic advantages. It posits that intelligence cognition practice is a multi-medium, multi-variable, continuous, and asymmetrically reciprocal intelligence cognition process completed by this community through interactive communication via interfaces composed of various tangible and intangible media in open political, economic, social, technological, and cultural environments. This process's openness, sociality, historicity, and practicality, along with the ultimately established symbiotic intelligence cognition advantages that are logically superior to the sum of individuals, align with Marxist symbiosis philosophy. This demonstrates that Marx's philosophical revolution not only achieved a transformation from ready-made to generative thinking at the methodological level, guiding individual intelligence generation research, but also that its embedded symbiosis thinking guides the exploration of intelligence symbiosis in knowledge communities.

Intelligence symbiosis mechanism research highlights the essence of intelligence cognition research that "the cognition process occurs at both ends of any communication system involved in information science research." While affirming the differential positioning of intelligence "users," it clarifies the "dual-subject" status of intelligence workers and intelligence users in intelligence cognition practice. This research treats the continuous asymmetric reciprocal symbiosis pattern as the ideal pattern of intelligence symbiosis and constructs a new normal for intelligence cognition based on this pattern, helping to eliminate absolutist and simplistic tendencies in intelligence symbiosis. It focuses on the authenticity of intelligence symbiosis contexts and the resulting practicality and scientificity of established intelligence cognition advantages, emphasizes the public practicality of intelligence symbiosis media, advocates constructing the real world in the mind through connections with the external world, and promotes achieving intelligence cognition through a professional community, a research or activity

domain, and a communication process. This provides a more solid theoretical solution for intelligence cognition practice oriented toward "high-end, precise, and in-depth" values.

4. Implementation Strategies for Intelligence Symbiosis

Intelligence symbiosis results from the comprehensive integration, interactive association, and cooperative progress of its various elements. By optimizing the intelligence symbiosis interface as the key approach, improving various elements and enhancing variables, practical strategies are formulated to strengthen the timeliness of intelligence symbiosis practice and demonstrate its responsibility in "high-end, precise, and in-depth" intelligence cognition practice.

The intelligence symbiosis interface is the foundation for forming and developing intelligence symbiosis relationships. To optimize its tangible and intangible symbiosis media: (1) Fully recognize the weaknesses of traditional intelligence cognition perspectives and the dilemmas they create for "high-end, precise, and in-depth" intelligence cognition practice, update concepts, and construct the spiritual cornerstone of the intelligence symbiosis interface with symbiotic and win-win ideas, making them the thinking coordinates of intelligence cognition practice. (2) Establish complementary intersections between intelligence workers and intelligence users on three key media: information organization and analysis, knowledge structure, and cognitive programs, making the dynamics of their interactive association greater than resistance, enabling effective formation and reasonable distribution of intelligence symbiosis energy, and breaking through "information blind spots" and "knowledge misconceptions" to establish intelligence cognition advantages. (3) Fully utilize various paper and electronic documentary information resources to build information commons and knowledge communities as cooperative exchange platforms, and reasonably draw upon "belief systems" with commensurability and social-historical attributes within academic communities to conduct intelligence symbiosis. Integrate the fruits of intelligence cognition practice from symbiosis into various information exchange platforms to achieve greater intelligence symbiosis tension.

Intelligence workers and intelligence users engage in intelligence symbiosis as heterogeneous units. To form, maintain, and develop symbiotic relationships between them, the correlation degree, symbiosis degree, information abundance, and symbiosis dimension must be enhanced and controlled: (1) Comprehensively improve the core capabilities contained in both parties' quality parameters—the former should be dedicated to improving information management capabilities, mastering context-based integrated information query and retrieval methods, and using various analysis software represented by CiteSpace to conduct information analysis; the latter should focus on expanding disciplinary knowledge vision and enhancing academic foundation, closely monitoring and firmly grasping disciplinary research hotspots and frontiers. Only in this way can both parties demonstrate excellent internal endowments to each other, making them the preferred choice for forming an intelligence cognition community. (2) Firmly

establish critical thinking, dedicated to maintaining static and dynamic equilibrium of relevant variables. Under the premise of prioritizing the selection of symbiotic objects with strong core capabilities and good cooperation, avoid the "empty" and focus on the "substantial," strictly control the rational division of labor and cooperation priorities between the two parties at each node of intelligence symbiosis, both generate sufficient intelligence symbiosis energy through complementary capabilities to ensure both symbiotic parties establish intelligence cognition advantages, and ensure both parties obtain reasonable benefits from intelligence cognition practice through detailed cooperation contracts.

To leverage the incentive and positive effects of the intelligence symbiosis environment on the intelligence cognition community, first utilize various favorable external conditions granted by social and economic development, regulatory policy control, and scientific and cultural progress to conduct top-level design for innovative intelligence cognition practice led by intelligence symbiosis concepts, creating a work atmosphere, academic atmosphere, cultural atmosphere, and living atmosphere conducive to intelligence symbiosis practice. Second, for specific research projects, establish subject service teams (intelligence cognition communities) comprising library subject librarians, support librarians, professors, experts, and doctoral/master's students. Relying on vertically and horizontally coordinated library subject service systems and corresponding performance evaluation mechanisms, implement dynamic personnel management, break through inherent role division and interest distribution barriers in intelligence cognition practice, enable the entire team to concentrate on collaborative cooperation with shared benefits, and achieve intelligence cognition practice goals.

Conducting intelligence symbiosis research guided by symbiosis theory extends the exploration tentacles of symbiosis theory. This research absorbs the essence of symbiosis theory, explores the mechanism of intelligence symbiosis, and achieves sublimation at the philosophical level, realizing the organic combination of symbiosis theory inheritance and intelligence cognition theory innovation. It formulates implementation strategies for intelligence symbiosis based on actual conditions, focusing on both overall design and specific details, making the new solution for intelligence cognition practice embody the dialectical unity of path and method, macro and micro.

Intelligence symbiosis research guides intelligence cognition research from "individual generation" to "community symbiosis," achieving a more comprehensive and appropriate interpretation of intelligence cognition theory and practice at the level of symbiosis theory. Establishing intelligence cognition communities for specific research projects, conducting intelligence cognition practice, and building intelligence highlands that track research hotspots and frontiers not only verifies the correctness of the entire research but also tests the performance of intelligence symbiosis. This represents both the unfinished aspects of this paper and expectations for future research.

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Note: Figure translations are in progress. See original paper for figures.