

Several Fundamental Problems in the Exploration of Information Theory: Postprint

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Abstract

Uncertainty constitutes the primary challenge confronting intelligence work, and intelligence research addressing uncertainty represents a fundamental theme in both intelligence theory and practice. This paper expounds upon several foundational cognitive issues in intelligence that must be resolved during theoretical exploration of uncertainty, encompassing: fundamental concepts of intelligence, intelligence task scenarios, intelligence assessment requirements, intelligence analysis methodologies, intelligence theoretical research, intelligence system capabilities, and the development of the intelligence discipline. It further proposes that the normative methodology for intelligence practitioners conducting research and analysis on uncertainty-related problems should adhere to the principle of “eliminating terminological confusion, balancing development and security, grounding in resource organization, emphasizing perception and characterization, prioritizing clue discovery, and strengthening systemic capabilities.”

Full Text

Several Basic Issues in Intelligence Theory Exploration

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Abstract:

[Purpose/Significance] Uncertainty is the main problem faced by intelligence work, and intelligence research addressing uncertainty constitutes a fundamental topic in both intelligence theory and practice. [Method/Process] This article elaborates on several basic issues in intelligence cognition that must be resolved when exploring intelligence theory aimed at uncertainty, including: basic concepts of intelligence, intelligence task scenarios, intelligence assessment requirements, intelligence analysis methods, intelligence theory research,

intelligence system capabilities, and intelligence discipline construction. [Result/Conclusion] It is proposed that the normative approach for intelligence workers to conduct research and analysis on uncertainty issues should be “not to be restricted by titles, to take account of both security and development, to be based on resource ordering, to emphasize awareness and description, to highlight clue discovery, and to strengthen system capabilities.”

Keywords: intelligence research; uncertainty; intelligence awareness; complex information environment

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In this era of unprecedented global changes, intelligence theory and practice are being tested and evolving through these trials. During this evolution, the complex information environment has made the uncertainty inherent in intelligence objects and topics increasingly active. In September 2019, the Intelligence Science Reading Group focused its annual theme on “uncertainty,” concentrating intelligence theory and practice research on this challenge [1]. In June 2022, researchers including Zhao Zhiyun from the Institute of Scientific and Technical Information of China, experts working on the front lines of national scientific and technical intelligence, raised questions about constructing a theoretical system for scientific and technical intelligence under complex information environments, highlighting the importance of theoretical exploration based on intelligence task scenarios [2].

Intelligence theory research is grounded in correct professional cognition, and theoretical research achievements are implemented through systems, processes, and methods related to intelligence operations and academic research. Therefore, to explore intelligence theory addressing uncertainty under complex information environments, we must first resolve basic issues in professional cognition. These basic issues spark intense interest and lively discussion among intelligence business managers and career builders, influencing the direction of professional development. Common fundamental issues in intelligence theory exploration include: basic concepts of intelligence, intelligence task scenarios, intelligence assessment requirements, intelligence analysis methods, research and exploration approaches, intelligence system capabilities, and intelligence discipline construction.

1 Understanding Basic Intelligence Concepts

The conceptual confusion between the terms “intelligence” and “information” often causes misunderstanding in academic circles, typically resulting from the disconnect between intelligence cognition and intelligence practice. Professor Wang Wanzong, former head of the Department of Information Management at Peking University, provided a definition of “intelligence” in the 1980s: “Intelligence is the selective transmission of information that promotes users’ current endeavors,” explaining that “this expression has purpose, timing, action, and

content objects. The behavioral meaning embedded in ‘intelligence’ reflects a social phenomenon, while knowledge cannot capture the essential attributes of the intelligence concept (without material there would be no transportation, but as the object of transportation, material cannot reflect the substantive meaning of transportation)” [3]. Shi Bingneng, former director of the National Defense Science and Technology Information Center, reiterated Qian Xuesen’s assertion in 2000 that “Intelligence is the knowledge and situation needed to solve specific problems (such as generating solutions, making decisions, implementing actions, and formulating plans). Intelligence is produced from data and information, but data and information are not intelligence; they are merely the foundation for generating intelligence. Intelligence must also undergo an activation process, which is the scientific process of analysis, judgment, and synthesis to become the knowledge and situation needed to solve specific problems” [4]. Although these two conceptual expressions appear different in form, they still receive solid practical support when placed within the context of intelligence task scenarios.

From the purpose of intelligence, we can see that the intelligence studied in intelligence science is “special information” that is specific, serves decision-making, solves information incompleteness problems in management decisions, and has undergone analytical processing and abstract refinement. Both intelligence materials and intelligence products can be presented in the form of information, and intelligence work can be regarded as special information work. Therefore, using the term “information” to express “intelligence” in academic or practical exchanges is an understandable practice. International investigations show that countries like Japan and South Korea also flexibly use these terms according to context without causing cognitive confusion [5]. As for security concerns such as classified versus unclassified, these merely define the boundaries of task conditions, reflecting the utility attributes of intelligence rather than its essential connotation.

2 Understanding Intelligence Task Scenarios

Intelligence task scenarios depict and describe the circumstances of intelligence work performed by organizations under special information environmental conditions to complete specific types of tasks. The information environment in which modern intelligence work operates can be described as complex, characterized by “multiple sources,” “numerous media,” “diverse formats,” “temporal shifts,” “rich derivatives,” “dense fog,” and “specialized knowledge.” Multiple sources, numerous media, and diverse formats refer to the richness of information channels, carriers, and formats in the intelligence work environment. Temporal shifts and rich derivatives specifically refer to the need to grasp particular spatiotemporal connotations when interpreting information content and utility. Dense fog refers to the need to recognize the strong interference that information fog, woven from true and false information, poses to analytical decision-making. Specialized knowledge emphasizes the importance of professional domain knowledge and skills in information analysis and processing.

The occurrence of intelligence tasks is not unrelated to intelligence users' needs and concerns. Regardless of the task form adopted to respond to requirements raised by intelligence users, intelligence task subjects are helping users understand specific decision-making objects of concern to eliminate cognitive blind spots and reduce judgment surprises. Intelligence task scenarios occurring under complex information environmental conditions contain rich research clues for exploring modern intelligence theory.

Under the joint determination of existing information resource control conditions and intelligence requirements, intelligence agencies and workers can organize and complete four types of intelligence tasks: information services, information sharing, intelligence response, and intelligence awareness. Information services refer to intelligence task subjects using information query, retrieval, and processing techniques to meet users' information needs by leveraging information resources under their control. Information sharing refers to intelligence task subjects, under relevant technical support and institutional guarantees, utilizing resources controlled by other peer subjects to provide information services to users through shared operations. Intelligence response refers to intelligence task subjects employing intelligence workflow methods to search for and analyze insufficient information materials when required information resource reserves are inadequate, and to respond to task requirements proposed by leading organs with the resulting intelligence products. Intelligence awareness refers to the handling of unknown or inadequately understood intelligence problems by intelligence task subjects, specifically defined as "intelligence professionals comprehensively applying various knowledge tools during routine information collection, processing, and analytical handling to complete cognition, interpretation, and expression of intelligence user needs, intelligence object content, and intelligence task organization" [6]. The problems targeted by intelligence awareness typically have no precedents to follow, making it difficult to directly derive results through simple analytical techniques, and often possess forward-looking, complex, strategic, or risky characteristics.

3 Clarifying Intelligence Assessment Requirements

Intelligence assessment is the most frequently conducted analytical behavior in intelligence work. Assessment objects can be intelligence materials or products, or the intelligence enterprise, agencies, or work itself. Analysts often conduct "value" measurement during assessment implementation, making "intelligence value" a common term in professional exchanges. In intelligence task contexts, intelligence value reflects people's perception and evaluation results of the empowerment provided by intelligence content or intelligence work. Intelligence empowerment actually improves or enhances intelligence users' decision-making capabilities, helping users reduce cognitive surprises in expected judgments about decision domain situation development. Measuring intelligence value involves neither calculating economic benefit indicators nor counting information capacity, and certainly not tallying so-called approval counts for intelligence product

delivery.

The purpose of intelligence analysis and the requirements of intelligence task objectives determine that assessment standards should be established around the distinctive intelligence mission of “early warning and far-sightedness.” Perceiving and exploring “unknown” issues and revealing warnings about uncertain futures to reduce “surprises” is where the true value of intelligence work lies. The conditions for realizing intelligence value should become the content of intelligence assessment standards. For intelligence materials or products, the demands of “accuracy,” “speed,” and “agility” jointly construct the corresponding evaluation standard system. For the intelligence enterprise or business, the “breadth of resource spectrum, frequency of scanning and monitoring, depth of insight and perception, and appropriateness of depiction and response” constitute the components of evaluation standards. Therefore, intelligence assessment should avoid simplistic, mechanical, and formalistic approaches, should advocate concrete analysis of concrete problems, and should encourage adherence to the intelligence work principle of “standardized operational processes with open analysis and judgment.”

4 Analyzing Intelligence Research Methods

Intelligence research methods play a very important role in intelligence task management and constitute indispensable key content. The analytical skills reflected in good intelligence products often leave deep impressions. In the history of the People’s Republic of China, scientific and technical intelligence experts designed unique data processing methods tailored to national industry characteristics, solving analysis problems of incomparable equipment data from different sources and models, providing strong intelligence support for equipment and technology strategic planning, and leaving behind legendary intelligence research cases. Changes in information technology and information environmental conditions have never diminished the intelligence community’s emphasis on intelligence research methods and tools. Europe and the United States have used efficient intelligent algorithms for clue discovery and perception detection of disruptive technologies, laying the foundation for algorithmic warfare concepts and reflecting the important role of intelligence research method exploration in the technology competition battlefield.

Precisely because the design and selection of methods and tools are crucial for solving specific intelligence problems, intelligence workers sometimes place excessive hope on discovering methods and tools, expecting to find some universal algorithmic model to solve intelligence analysis problems in big data environments. However, intelligence practice history repeatedly proves that the selection and design of intelligence research methods and tools depend on numerous conditions including task requirements, data foundations, and analysts’ professional skills. The development and use of intelligence research methods and tools cannot be separated from specific intelligence work scenarios and are constrained by specific intelligence task requirements, specific intelligence data

foundations, and specific subjective capability conditions of analytical subjects. The basic viewpoint that should be held when involving intelligence analysis methods and tools is that we cannot expect to have fixed-paradigm, all-purpose analysis methods and tools. Just as intelligence work can only make certain contributions to solving information incompleteness problems, specific intelligence analysis methods and tools can only handle specific problems in specific situations. Based on work task scenarios, dealing with matters as they stand, seeking truth from facts, and conducting concrete analysis of concrete problems are the fundamental principles of intelligence research methodology.

Although development and change are the eternal paradigms of intelligence, there remain some relatively stable habitual practices in intelligence research fields, such as horizon scanning, systems analysis, blind spot analysis, and diagnostic analysis (also known as “competitive hypothesis analysis” in literal translation from foreign texts), which have become basic components of intelligence research analysis norms. The use of such normative methods is often related to intelligence task decomposition (workflow) and analysis quality control. For example, horizon scanning, based on robust and solid information resource guarantees, identifies, discovers, and assesses emerging or disruptive frontier technologies through combined operations of “full-spectrum scanning and extreme perception.” Many developed countries and international organizations persistently use horizon scanning methods to effectively support modern technology development strategy decisions [7]. Systems analysis, balancing dynamic and static aspects and delving into mechanisms, focuses on elements, relationships, impacts, and environments, and is widely applied in comprehensive strategic intelligence research across political, economic, military, technological, cultural, and social domains. Blind spot analysis and diagnostic analysis are summarized from intelligence analysis practical experience and lessons, overcoming inherent knowledge and cognitive pitfalls in intelligence analysis agencies and personnel through institutionalized means of workflow and task control [8]. Using determined institutionalized means to address universal uncertainty problems is the common highlight of normative intelligence research methods.

5 Grasping Intelligence Theory Research

Intelligence theory originates from intelligence practice. Theoretical achievements derived from practice not only sort out, summarize, and sublimate the laws, rules, methods, tools, and cognition of intelligence objects, but also provide analytical reference bases for subsequent intelligence business development and career regulation construction. Throughout history, intelligence practitioners at home and abroad have often written works to establish theories. Interpretations of works like Sun Tzu’s *The Art of War • Employing Spies* in Chinese history need no elaboration, and classic textbooks used by China’s intelligence research and education institutions also include contributions by top experts. Foreign intelligence experts are also very active in intelligence theory exploration, with various types of intelligence agencies having mechanisms for writing and shar-

ing exchanges. Intelligence experts and scholars often hold dual identities, with experiences, lessons, insights, techniques, methods, and concepts being systematically and categorically recorded and displayed on intelligence academic platforms.

The significance of intelligence theory research lies not only in summarizing existing practice but, more importantly, in sharpening intelligence practitioners' professional wisdom and helping with future-oriented professional and career planning and design. The history of intelligence career development shows that active intelligence business practice is always accompanied by flourishing intelligence academic theory research, with the two being mutually promoting or constraining key factors.

Conducting intelligence theory research requires avoiding two extreme tendencies: the pursuit of "innovation" detached from intelligence reality and short-term utilitarianism. Innovation is the common pursuit of researchers. If intelligence theory research neglects intelligence purposes in the quest for so-called innovation, vulgarizing the requirement for international perspectives as formalistic so-called international integration, it will fall into an "innovation" 误区 that, despite producing novel forms of output, neglects rigorous examination of the intrinsic essence of practical development and fails to provide constant guidance, planning, and management assurance for intelligence practice. In recent years, controversial phenomena in intelligence theory and practice related to the implementation of overall national security concepts and new-type think tank construction have highlighted cognitive blind spots caused by non-pragmatic theoretical "innovation." For example, the common practical approach of "doing intelligence in the name of information" actually struggles to find mapping resonance in theoretical research. In reform practice, the inherent strengths of intelligence business and agencies have not been emphasized and utilized, while their resource advantages, work advantages, and talent advantages have been distorted and weakened, which is particularly detrimental to the development and exploration of intelligence careers with Chinese characteristics. Calls for pragmatic theory in innovative exploration have become increasingly prominent.

The rapid development of information technology has changed the information environment in which people work and live, requiring adjustments and reflections in intelligence work conditions and business content. Intelligence theory researchers have great selectivity in objects of attention and material extraction, but they can easily become lost in the colorful information world. Influenced by new technologies and new public opinions, they may overemphasize rapid response to "new" things, eagerly citing, transplanting, and grafting newly emerging terms and technologies, making it difficult to maintain the 定力 required for academic research. Operational terms like "big data" have been hyped into academic concepts, and the phenomenon of "某某" intelligence (studies) springing up everywhere reflects that academic theory research is facing the risk of becoming superficial and shallow.

6 Enhancing Intelligence System Capabilities

The realization of national development and security is essentially the result of system confrontation and cooperation. Related issues need to be considered from a comprehensive strategic level, and solving such problems ultimately tests system capabilities. As early as 2004, the U.S. military introduced the “system of systems” concept into the weapons and equipment acquisition domain, defining the term SoS (System(s) of Systems), which integrates mission-oriented dedicated system resources and capabilities through coordination methods such as virtual, collaborative, or directive approaches to create more complex system collections or layouts with unique capabilities. The formation and application of intelligence system capabilities follow the same principle [9].

The basic components constituting and applying intelligence system capabilities include both individual intelligence capabilities of intelligence agencies or professional workers and intelligence governance regulations. Research on intelligence system capabilities should adopt dynamic, systematic, and ecological perspectives.

Shaping and enhancing intelligence system capabilities requires properly handling the integration of “war” and “learning” and the mastery of “principles” and “techniques.” The “war” and “learning” integration issue reflects the special requirements for intelligence capability development, which needs both learning from predecessors’ experiences and the conscious awareness of learning war through war. The U.S. military’s After Action Review (AAR) system, conducted after all mission operations, offers excellent reference and inspiration for intelligence workers to enhance professional cognition and analytical capabilities through practice. Survey data from China’s professional intelligence agencies also show that institutions emphasizing intelligence academic research and evaluating intelligence academic achievements in daily management can better respond to intelligence tasks and demonstrate stronger task adjustment adaptability and sustainable development capabilities [10].

The “principles” and “techniques” mastery issue reflects understanding and application skills regarding methodologies. In education and training for intelligence professionals, people often emphasize learning and using specific methods and tools. However, in actual intelligence problem response, how to select, combine, and even transform these methods and tools is more critical. “Understanding principles to master techniques” is a common requirement for intelligence workers. The “principles” here refer to principled and regularized understanding, while “techniques” refer to specific means and operational steps. Taking scientific and technological project path research as an example: “Understanding principles” means knowing that the research domain for path issues must include development goals, key nodes, and evaluation criteria; “Mastering techniques” requires selecting and using specific analytical tools and methods according to the inherent attribute characteristics and requirements of goal-oriented issues, node issues, and standard issues, as well as existing data and object regularities.

The more severe the struggle situation and the richer the information means, the more urgent the requirements for intelligence system capability construction. Against the backdrop of national strategic scientific and technological strength construction, the clue discovery capabilities embedded in professional operations such as “scanning and foundation building, perception and guidance, correlation and demonstration, depiction and presentation, and response and monitoring” will become important components of modern intelligence system capability construction.

7 Planning Intelligence Discipline Construction

Intelligence discipline construction is the existence foundation and manifestation form of intelligence academic activities. The positioning of intelligence discipline construction should avoid pursuing the transformation of this discipline into an all-capable “know-it-all” or jack-of-all-trades. The commonly discussed “T-shaped” knowledge structure requirement for intelligence agencies and researchers aims to better employ intelligence professional skills to excavate, discover, and utilize professional judgments from various fields, because specific domain problems encountered usually cannot be solved directly using intelligence professional methods but require analysis and processing by domain experts using specialized knowledge and skills. Precisely because leveraging intelligence business expertise can more conveniently discover and identify clues worth in-depth investigation, intelligence agencies and researchers, although they cannot “know everything,” have the capability to “know what can be expected” or “know what to do when encountering issues.” Therefore, intelligence discipline construction needs to anchor itself to the fundamental purpose of intelligence, aiming to enhance system intelligence capabilities, reduce and prevent decision-making cognitive surprises, and support strategic management early warning and navigation. Focusing on resources, technology, systems, and personnel, it should highlight the professional specialty of clue discovery and concentrate on theoretical and practical research regarding intelligence careers, intelligence business, and intelligence education.

Intelligence discipline construction must adapt to changes in national development tasks and situational environments, with innovation, adjustment, and comprehensive balance of contradictions being a normal state. Various perspectives on intelligence discipline construction are also well-founded. As the overall national security concept becomes deeply rooted in people’s hearts and the National Security Law and National Intelligence Law are successively promulgated, there are growing calls to label intelligence as “secret” and incorporate intelligence discipline construction into the national security discipline system. These have added self-examination momentum and reference objects for intelligence discipline construction, motivating intelligence scholars to carefully distinguish between operational and academic concepts, scrutinize the positioning differences between “taking account of both” or “coordinating” development and security and “orienting toward” development and security, and reminding dis-

cipline planning managers to emphasize disciplinary ecology.

A healthy intelligence disciplinary ecology should enable its elements to co-exist, co-prosper, and progress together, capable of functional construction and strengthening through self-organization, self-growth, self-adaptation, and self-correction mechanisms. Disciplinary ecological elements include not only the goals, processes, and methods of various intelligence tasks but also intelligence agencies, personnel, education, and regulations. A healthily growing intelligence discipline needs to withstand the measurement standards of “remaining true to original aspirations, maintaining keen perception, and continuous accumulation.” Its overall performance should feature complete spectrum resource guarantees, effective collaboration among professional agencies, active academic achievement exchanges, and orderly distribution of research teams.

In analyzing intelligence discipline construction planning, we must note that discipline existence has historical inevitability, intertwining objective academic logic and subjective intervention will. Human intervention has immediate effects in the short term and even more profound impacts in the long term. If subjective intervention aligns with the academic logic of discipline development, discipline construction achieves remarkable results and natural disciplinary status. If subjective intervention contradicts or deviates from the academic logic of discipline development, discipline construction inevitably produces exaggerations and awkward disciplinary status. The special nature of intelligence work makes intelligence academic research highly susceptible to institutional setup influences, which is why departmental or domain intelligence studies emerge. Without a global and historical perspective, intelligence discipline development based on departmental or domain intelligence studies loses coordination, and the discourse power of scholars from various departments or domains on disciplinary exchange platforms becomes unbalanced. This neither meets the requirements of national intelligence system capability construction nor affects the healthy development of the intelligence discipline.

China’s scientific and technical intelligence studies have historically experienced 纠结 caused by naming with either “intelligence” or “information.” Reflecting on this is particularly beneficial for current discipline construction planning and business layout adjustment. “Not to be restricted by titles, to take account of both security and development, to be based on resource ordering, to emphasize awareness and description, to highlight clue discovery, and to strengthen system capabilities” is the correct approach for scientific and technical intelligence workers to conduct research and analysis on uncertainty issues, and also an option for mutual encouragement among intelligence research workers in other specialized fields.

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

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