Mechanism and Path Analysis of Information Audience Opinion Measurement in Online Public Opinion Fields: Postprint

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Abstract

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Full Text

Preamble

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Mechanism and Path Analysis of Information Audience Opinion Measurement in the Network Public Opinion Field

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Abstract

[**Purpose/Significance**] Integrating qualitative and quantitative perspectives in public opinion research, unifying multimodal research objects, and achieving opinion measurement of network public opinion information audiences can bridge the theoretical and practical divide in network public opinion analysis and governance. [**Method/Process**] By introducing the concept of the network public opinion field, this paper interprets the connotations of network public opinion information audiences and audience opinion measurement, and dialectically discusses the logical relationship between the network public opinion field and information audience opinion measurement. [**Result/Conclusion**] The paper proposes the mechanism and specific measurement paths for public opinion audience opinion measurement within the network public opinion field, laying groundwork for subsequent research on network public opinion information analysis, multidimensional information audience opinion measurement, discovery of audience cognitive patterns, and network public opinion supervision and control.

Keywords: network public opinion field; information measurement; sentiment analysis; measurement mechanism and path
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1. Research Background

In recent years, the escalating group incidents triggered by network public opinion in China have prompted intensive research and reflection from social management entities and academia. Numerous facts demonstrate that the critical link in network public opinion analysis and governance lies in the precise analysis of ubiquitous online public opinion information and the reasonable intervention in audience opinion trends and emotional polarization. However, under current objective constraints, such efforts cannot leverage big data for full-scale analysis, nor can they achieve cross-analysis and integrated revelation of the subjective and objective characteristics of network public opinion. In response, this paper proposes introducing field theory to integrate qualitative and quantitative research perspectives, unify multimodal research objects, realize opinion measurement of network public opinion information audiences, and thereby repair the theoretical-practical rift in network public opinion analysis and governance.

As a special domain in network public opinion research, the public opinion field—also called the 舆论场—represents a hybrid concept derived from physical fields [1], information fields [2], psychophysical fields [3], audience communication fields [4], and social fields [5]. Some scholars have directly grafted the psychophysical field concept from Gestalt psychology onto the network pub-

lic opinion field, deconstructing it into three components: psychological field, new media field, and social field [7]. Other literature has defined the composite spatiotemporal characteristics of network public opinion fields, describing their function as release and monitoring of objective society [8] and as the result of continuous differentiation in public opinion carriers and space [9]. Current application-level research on network public opinion fields remains scarce, with representative works including: Wang Yuzhu [10] extended the concept to WeChat public opinion fields, analyzing issue-setting characteristics driven by interpersonal networks, self-purification status, and positive/negative impacts on group polarization control; Li Changzu et al. [11] proposed the "micro-circle" concept, using field theory to explain its formation, evolution, and state correlation mechanisms, describing its field independence and spatial constraints, and exploring its potential for public opinion information classification; Wu Shixian et al. [12-13] employed quantitative thinking based on the mathematical functions of network public opinion fields to simulate group polarization phenomena, constructing audience communication field models and developing algorithms for predicting polarization degree and identifying opinion leaders.

Literature review reveals that specialized research on network public opinion fields remains extremely limited, with most studies treating the concept as an axiom without fully leveraging its mathematical characteristics for measuring audience subjective cognition and behavioral quantification. As early as 1992, scholars compared public opinion fields with physical and information fields, categorizing them into variable vs. stable fields, sub-fields vs. composite fields, and primary vs. additional fields [6]. Some directly transplanted the psychophysical field concept to network public opinion fields [7]. The authors' prior research defined network public opinion fields as the fundamental form of network public opinion existence, possessing direct materiality and indirect derivability [14], reflecting audience subjective consciousness while simultaneously influencing their cognitive states and opinion tendencies. These fields represent spatiotemporal domains attached to network public opinion information production/consumption, acquisition/sharing, and assimilation/dissimilation processes, with structural, state, and functional characteristics determined by audience cognitive quantities and concretely manifested through the movement states of network public opinion information [15].

2. Tasks of Network Public Opinion Information Audience Opinion Measurement

Measurement is fundamentally a mathematical concept studying algebraic operations on measurable element sets in space. Network public opinion information audience opinion measurement essentially constitutes a branch of information measurement. Dr. R.C. Shannon [16] first used the bit concept in 1938 to measure information with uncertainty attributes, with subsequent developments in logarithmic perspective principles, mutual information, and fuzzy information measurement marking the maturation of information measurement theory. This

paper's proposed network public opinion information audience opinion measurement similarly represents a branch of information measurement, transforming and integrating both additive measurements (explicit public opinion information and audience information behaviors) and non-additive measurements (audience implicit cognitive states and tendencies). Specifically, this includes four aspects:

2.1 Exploring Network Public Opinion Audience Psychological Characteristics and Associated Information Behaviors

The complex characteristics of network public opinion audiences make describing their 先导型心理现象 (leading psychological phenomena) and subsequent behaviors during participation extremely difficult. However, depicting audience individuals' participation motivations and cognitive modes helps summarize social expectations and frustrations of online publics within network public opinion fields. Distinguishing audience types based on individuals' claims, arguments, and information behaviors—for audiences such as jesting-conformist types, strongly-motivated extreme types, interest-driven types, and rigorously logical opinion leaders—enables more effective governance outcomes through targeted intervention measures.

2.2 Revealing Network Public Opinion Audience Group Characteristics and Mobilization Patterns

Although individual audience members may appear random and disorderly in network public opinion events, examining individual psychological phenomena and information behaviors within homogeneous groups reveals simple, logical patterns beneath diverse individual expressions. This universal principle reflects not only group commonalities but also explains why group behaviors differ from individual actions. Therefore, investigating the formation mechanisms of homogeneous communities can deduce key triggering factors for audience group polarization and general patterns of grievance mobilization, providing guidance for predicting 濒临极化群落 (polarization-prone communities) and controlling online-to-offline behavioral transitions.

2.3 Grasping Overall Network Public Opinion Fermentation Trends

Measuring network public opinion information audience opinions also enables panoramic outlining of public opinion fermentation and derivation trends within the field. Only when network public opinion reaches certain participation scales and attention levels can it evolve into online/offline crises. Observing audience emotional preferences and opinion attitudes across temporal stages facilitates control over critical fermentation nodes and quantification of crisis levels, thereby enabling governance personnel to handle events holistically and targetedly.

2.4 Flexibly Setting Emergency Intervention Measures

The social contradictions and class resentments ignited by rampant network public opinion have severely impacted China's online environment purification and social harmony. Consequently, situation assessment, crisis response, and

governance 疏导 constitute the ultimate goal of network public opinion audience opinion measurement. However, rigid governance measures cannot cope with rapidly changing network environments. Since audience opinions represent emotional projections toward events and social ecology, and given information science's disciplinary attributes, network public opinion analysis and governance must focus on the information dimension. As public opinion information nearly equates to audience opinions and attitudes, quantifying them through technical means not only facilitates but necessitates flexible network public opinion governance measures.

3. Mechanisms of Information Audience Opinion Measurement Within the Network Public Opinion Field

Opinion measurement encompasses not only explicit textual information but also various audience information reception and usage phenomena. Any opinion measurement practice targeting arbitrary objectives must cover numerous variables and conditions with extremely complex states and forms. Therefore, seeking measurement approaches adapted to the complex state characteristics of network public opinion audiences—where subjectivity and objectivity coexist—and constructing an integrated functional system unifying macro/micro, partial/whole, qualitative/quantitative, and local/global perspectives ensures successful completion of various measurement tasks. Introducing the network public opinion field concept thus becomes both appropriate and necessary for public opinion information audience opinion measurement. The corresponding functional relationships between network public opinion fields and information audience opinion measurement can be elaborated across five dimensions:

3.1. Representation Mechanism of Measurement Objects by Network Public Opinion Fields

Network public opinion audience opinion measurement objects extend beyond explicit information and behavioral traces within the field to include emotional attitudes implied in observable data (with clarity determined by information expression methods), audiences' initial cognitive schemas, emotional tendencies of non-explicit opinion-expressing audiences, intensity and persistence of these emotional indicators, and mutual interaction relationships demonstrated through opinion feedback loops among audiences. Attempting to directly present such complex, abstract measurement objects without mediation would be futile. The structural functions and natural characteristics of network public opinion fields enable representation of these obscure measurement objects, concretizing them and extending influence relationships on the audience's subjective cognitive level to render them quantifiable. Moreover, since public opinion fermentation represents a complex multi-factor process, opinion measurement must accommodate concurrent multi-object measurement and collaborative action pattern revelation. Network public opinion field connotations encompass not only ubiquitous network technology carriers but

also unify objective socio-political-cultural environments, public subjective psychological-cognitive structures, and network public opinion information into a complete conceptual system, thereby satisfying functional requirements for concurrent detection of multiple measurement objects.

The relationship between network public opinion fields and various audience opinion measurement objects is mutually interpretive. As shown in Figure 1 [Figure 1: see original paper], field forces, field intensity, field potential, field polarity, and life cycles respectively represent metrics for audience opinion interaction, public opinion event heat, audience opinion potential attractiveness, mainstream opinion dominance, and timing for public opinion intervention. On one hand, the explicit characteristics and structural functions of network public opinion fields represent the universal patterns of audience subjects' explicit information and implicit attitude activities. On the other hand, when individual cases are identified as measurement objects, they become specific manifestations of network public opinion existence and movement within the field—explained by universal patterns while simultaneously reinforcing them.

3.2. Boundary Segmentation Mechanism of Network Public Opinion Fields

In current environments, highly sensitive or attractive emergencies inevitably trigger competitive reporting from both official media and self-media, causing derived network public opinion to permeate the entire network and severely hindering audience opinion measurement research. Ubiquitous public opinion information exhibits clear big data characteristics, rendering conventional information science research methods powerless against full-domain data. Simple sampling measurement not only deviates from big data analytical thinking but also fails to reflect universal conclusions. While big data technology offers solutions, it faces insurmountable obstacles: (1) commercial confidentiality makes full-domain data acquisition extremely difficult; (2) high complexity and demanding hardware/software requirements constrain academic mastery and adoption.

Network public opinion field introduction can partially overcome these obstacles. The extension of network public opinion fields determines flexible, dynamic opinion measurement domain division standards. Macroscopically, the full spatiotemporal internet region where opinion dissemination, differentiation, aggregation, and persuasion occur regarding specific public opinion events constitutes an integrated network public opinion field. Microscopically, however, an integrated field can be deconstructed into multiple sub-fields (e.g., Baidu Tieba, Weibo platforms). These sub-fields can be treated as independent network public opinion fields during research, thereby delineating clear measurement boundaries and experimental environments with full-data measurement conditions. Essentially, big data also operates on full data within commercial databases through high-speed algorithms and hardware—requiring clear boundaries. The misconception of processing entire network data arises solely from massive ca-

pacity. Similarly, network public opinion fields provide logical foundations for full-data processing within measurement scopes in academic research, as shown in Figure 2 [Figure 2: see original paper].

3.3. Organization Mechanism of Measurement Methods by Network Public Opinion Fields

As previously summarized, network public opinion information audience opinion measurement represents a branch of information measurement. Since information mediates between physical and spiritual worlds, audience opinions similarly connect the original world of public opinion events with the spiritual world of online masses. As fundamental components of network public opinion information, audience opinions are both derivatives of subjective consciousness and objective material carriers. Therefore, the attributes of macro-measurement objects determine the 多元化定局 (diversified pattern) of measurement paradigms and methods.

Network public opinion fields organize and integrate various audience opinion measurement methods into systematic methodologies. By connecting subjective spiritual worlds with objective material worlds through domain information communication and exchange activities, network public opinion fields form a public opinion ecosystem. All internal element interactions and changes manifest through alterations in domain public opinion information structures. Thus, analyzing the interaction modes and qualitative representations of network public opinion field system elements essentially reveals measurement of audience explicit information and implicit psychological activities. Simultaneously, network public opinion fields statically and dynamically integrate information audience opinion measurement methods through internal information structures. If the public opinion information structure within an observation time window represents a relatively static organization process of measurement methods, then changes in this structure over time constitute a dynamic maintenance process of measurement methods. This organizational concept thus possesses dual significance: (1) revealing methodological constraint mechanisms for static relationships between audience subjective consciousness and explicit objective information; (2) revealing order construction for dynamically evolving relationship patterns. Both are achieved through field descriptions (movement patterns demonstrated by public opinion information connections and activities), as shown in Figure 3 [Figure 3: see original paper].

3.4. Interpretation and Evaluation Mechanism of Measurement Results by Network Public Opinion Fields

Various measurement tasks for public opinion audience opinions produce multiple results—some contradictory, some reasonable. Judging and interpreting the rationality of these results from isolated/static or connected/developmental perspectives constitutes a crucial step in translating theoretical exploration into

practice, directly determining the practical guidance potential for network public opinion governance.

Interpretation and evaluation must address result authenticity. Due to extensive subjective consciousness activities among information audiences, network public opinion measurement data remains in dynamic flux. Consequently, audience opinion activity trajectories measured within static time windows may represent false likelihood phenomena. This requires longitudinal comparison of pre- and post-field states from individual, group, and holistic perspectives to correct, discard falsehoods, and preserve truth, ensuring measured patterns remain coherent and logical.

Measurement result quality requires assessment. Constrained by data collection domain scales and cleaning methods, results exhibit varying precision. Overly narrow measurement boundaries may yield results insufficient for broader governance needs. In such cases, background facts must be expanded more extensively with reference to similar public opinion events to supplement evolution patterns attached to measurement results and enhance practical universality, as shown in Figure 4 [Figure 4: see original paper].

3.5. Environmental Simulation Mechanism for Measurement Result Application by Network Public Opinion Fields

Audience opinion measurement primarily aims to govern network public opinion more effectively and prevent deterioration. However, most researchers lack opportunities to participate in actual governance processes. Therefore, constructing simulated network public opinion governance environments through pre-segmented fields enables dynamic judgment of measurement results' practical utility and value. Moreover, due to the subjective-objective unity of network public opinion fields, domain structures, mathematical representations, and natural characteristics change following governance interventions, indirectly providing active feedback on measurement results' practical effectiveness. The validity of governance measures based on measurement results manifests through post-intervention field states. If governance effects prove unsatisfactory, post-intervention states guide governance personnel to adjust measurement result interpretation directions and domain governance strategies. This environmental simulation mechanism is illustrated in Figure 5 [Figure 5: see original paper].

Figure 5 implicitly suggests a potential shift in network public opinion governance thinking: transitioning governance objects and targets from network public opinion to network public opinion fields. Network public opinion fields integrate audiences, information, and fermentation environments into a single dimension. While emphasizing interactive relationships between audience sentiments and the field, this approach transforms abstract, sparsely-punctured network public opinion information management issues into concrete network public opinion field analysis and governance problems. By spatiotemporally associating big-data-shaped network public opinion information through fields,

this 突破 (breakthrough) overcomes previous governance thinking limitations and promotes evolution in network public opinion monitoring and response concepts.

4. Operational Path Analysis of Information Audience Opinion Measurement in Network Public Opinion Fields

Based on measurement task objectives, domain measurement practices are decomposed into three dimensions—individual, group, and holistic—with operational paths elaborated for each.

4.1. Individual-Dimension Measurement Path for Network Public Opinion Information Audience Opinions

The core of individual-dimension measurement lies in creating psychological profiles for each domain audience member. Through data trace analysis, interviews, and inquiries, this path reveals and describes audience participation motivations, attitude components toward events, and differentiation. It forms character images and activity representations of network public opinion information audiences through text and graphics. The current opinion exposure (explicit/implicit) status of network public opinion audiences at measurement nodes determines the dual-axis operational path.

On one hand, audience participation motivations possess strong implicitness; analyzing solely through domain information traces reflecting specific emotional-psychological 表象 (manifestations) would yield distorted, inapplicable conclusions. Therefore, this paper proposes using grounded theory to qualitatively excavate online masses' participation motivations, integrating formal concept analysis theory during initial concept encoding to blend quantitative elements into exploratory grounded theory research [17], achieving seamless qualitative-quantitative integration in measurement operational paths.

On the other hand, audience characteristics regarding explicit information behaviors, psychological processes, and cognitive differences require individual-dimension measurement. This study introduces quantitative approaches to measure explicit opinion differences among individuals, proposing to use mutual reference frames among enveloped audience individuals within the same public opinion event's cross-sectional plane. By introducing sentiment ontologies and 1-mode/2-mode association matrices to measure inter-individual cognitive distances, this enables mutual comparison and reference of cognitive patterns and emotional intensities [18]. The individual-dimension dual-axis operational path is illustrated in Figure 6 [Figure 6: see original paper].

Research on individual opinion explicit motivation analysis methods employs concept lattice technology and grounded theory to reveal audience opinion explicit motivations, assign weights to motivation types, and quantify implicit emotional intensity and opinion rigidity. Research on inter-individual cognitive

distance measurement utilizes natural language processing to segment scattered, colloquial audience comments, identify public opinion event entities, describe emotional intensity and orientation through sentiment dictionaries, and finally employs complex network mapping for "1-mode" and "2-mode" visual analysis of audience opinions, interpreting individual cognitive differences based on network public opinion field forces.

While individual-dimension measurement may not appear directly field-related beyond scope definition, motivation positioning and inter-individual cognitive distance quantification actually lay foundations for measuring field potential, field forces, and field polarity. These field functional representations further represent, interpret, and influence other dimension measurement performances, with individual-dimension result interpretation rights controlled by current field states. Thus, individual-dimension opinion measurement operational paths are indirectly realized through network public opinion field intervention.

4.2. Group-Dimension Measurement Path for Network Public Opinion Information Audience Opinions

The concept of "group" is often misunderstood as all participating audiences within the entire network public opinion field. However, this paper defines groups as information audience communities that form clear attitudinal tendencies in network public opinion fields through opinion feedback on source information and interaction with other audiences—group division is based on opinion and behavioral homogeneity/heterogeneity.

Group-dimension information audience opinion measurement primarily aims to clarify group polarization degrees and trends across domains to prevent group incidents. This study posits that for a homogeneous sentiment-formed audience community to evolve into a radical, action-prone, polarization-prone community, it requires one external condition and two internal conditions: the external condition is the objective evolution direction of public opinion events independent of "non-involved" audiences; internal condition one requires mainstream community opinions to possess firmness and continuity, triggering sustained emotional fermentation and extensive discussion; internal condition two requires core-attached emotional energy to approach saturation, continuously 粘合 (binding) new audiences' psychological identification while maintaining advantage against heterogeneous communities.

This study disregards external condition impacts on measured communities. Thus, group-dimension network public opinion information audience opinion measurement tasks can be equivalent to community robustness measurement problems. Robustness refers to system stability in maintaining original performance under internal parameter changes. Correspondingly, the two internal conditions can be summarized as community connection robustness and attraction robustness. The group-dimension operational path is illustrated in Figure 7 [Figure 7: see original paper].

Research on attraction robustness analysis methods for public opinion audience opinion communities based on network public opinion field potential integrates previous individual measurement results. It explores how changes in core audiences within different opinion-holding communities affect the emotional mobilization function and sustained fermentation capacity—specifically, the maintenance degree of opinion attraction capability toward non-community audiences when core members change. Specific measurement steps include: (1) measurement time window division; (2) core audience identification and quantification; (3) community connection robustness formula determination; (4) time-series core audience deletion mechanism construction; (5) target community connection robustness calculation; (6) simulating audience entry scenarios with semantic mapping to match real audience opinions; (7) weight assignment for cognitive rigidity degrees; (8) measuring field potential work required for individual cognitive removal; (9) repeating measurement after core audience deletion; (10) calculating cohesion robustness ratios; (11) time-series community cohesion robustness measurement.

Compared with the individual dimension, network public opinion field intervention is more direct in group-dimension measurement, with field forces and field potential directly participating as causes, manifestations, and metrics of community polarization processes. Individual-dimension measurement results serve as material for community robustness measurement, collaboratively achieving group-dimension objectives.

4.3. Holistic-Dimension Measurement Path for Network Public Opinion Information Audience Opinions

The holistic dimension refers to quantifying the emotional directions and energy contained in all audience explicit comments and behaviors within network public opinion fields during observation periods. Unlike individual and group dimensions, holistic-dimension measurement targets the qualitative and state attributes attached to explicit "field points" in domains, aiming to reveal field polarity and intensity by evaluating continuous emotional energy accumulation at field points.

The holistic-dimension operational path must address two issues: (1) selecting appropriate indicator systems for mathematical description of explicit opinion/behavior intensities; (2) accurately mapping semantic emotional orientations of evaluation texts and information behaviors to relevant public opinion event parties. After completing these steps, network public opinion field intensity and polarity formulas can be applied, concluding the holistic-dimension measurement process. The specific operational path is shown in Figure 8 [Figure 8: see original paper].

Research on overall opinion intensity analysis methods from a network public opinion field life cycle perspective employs semantic analysis and social metrology to mathematically model explicit opinion semantic intensities and infor-

mation behavior frequencies, thereby quantifying overall intensities of different emotional tendencies during various periods—i.e., field intensity. Based on these findings, mathematical modeling of emotional polarization degrees (field polarity) among audiences holding different positions achieves overall identification and control of current network public opinion field emotional states.

Holistic-dimension measurement essentially constitutes field polarity and intensity measurement. As previously stated, network public opinion field structural functions are represented by current field point states. Thus, field intensity and polarity equivalently represent event attention/audience emotion intensity and the power dynamics among audience opinion communities. Measuring the former essentially measures field forces and field potential within network public opinion fields.

4.4. Interrelationships Among Three-Dimension Measurement Tasks

After clarifying the three-dimension operational paths, their interrelationships can be extracted, as shown in Figure 9 [Figure 9: see original paper].

Three-dimension measurement tasks exhibit progressive, inclusive relationships from micro to meso to macro perspectives. Individual-dimension results provide foundational data for subsequent dimensions, with later dimensions explaining interrelationships among earlier dimension objects. A special relationship also exists: individual-dimension results directly associate with holistic dimensions, bypassing group dimensions. From a field functional perspective, field forces and field potential describe inter-particle interactions, with particle states existing as either explicit field points (measurable opinions and behaviors) or implicit wandering (audiences yet to publish explicit information). Field polarity represents a higher-level relationship description superimposed on particle interactions, while field intensity—though derived from direct energy accumulation at explicit particles—also requires classification models based on opinion communities, making it a macro-representation of meso-level particle relationships.

4.5. Discussion on Advantages of Field-Based Information Audience Opinion Measurement

While classic approaches—opinion evolution modeling, propagation network analysis, and dictionary/machine-learning-based semantic analysis—can achieve certain opinion analysis goals, they suffer from single-dimension limitations. Evolution models are heavily influenced by simulation data, propagation networks inadequately address audience position changes, and semantic analysis over-relies on dictionary/corpus quality, yielding partial results.

Field-based measurement dialectically absorbs these classic methods, unifying them within a single framework for complementary fusion. Field theory introduction directly associates field functional representations with opinion movement configurations, making field attribute measurement (forces, potential, polarity, intensity) equivalent to measuring opinion existence and movement

states. Moreover, current public opinion environments, past cognitive experiences, and other audiences' information behaviors can all trigger opinion publication and mutation. Network public opinion fields effectively enable quantitative measurement of these triggers while supporting qualitative analysis of resulting problems and solutions, thereby achieving multidimensional, multi-object, multi-method opinion measurement.

5. Conclusion

This paper focuses on mechanisms and operational paths of information audience opinion measurement within network public opinion fields. It interprets the connotations of network public opinion information audiences and audience opinion measurement, dialectically discusses logical relationships between fields and measurement, details operational paths across individual, group, and holistic dimensions based on field attributes, and exploratorily reveals interconnections among three-dimension measurement tasks. Due to space limitations, the proposed principles and paths remain theoretical descriptions supported by prior research, with more practical measurement work under these principles to be developed in subsequent studies.

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Author Contributions

Song Xianzhi: Proposed research ideas and wrote the paper
Huang Wei: Designed research objectives and framework
Gao Junfeng: Constructed the paper's system

Study of the Mechanism and Path of Information Audience Opinion Measurement in the Network Public Opinion Field

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Abstract: [Purpose/significance] This paper studies the opinion measurement of network information audiences, integrating qualitative and quantitative methods and multimodal subjects to enrich theory and practice in network public opinion analysis and governance. [Method/process] It introduces the network public opinion field concept, explains network public opinion audiences and opinion measurement, and debates the logical relationship between fields and measurement. [Result/conclusion] The article proposes measurement mechanisms and concrete paths within network public opinion fields, paving the way for subsequent research on network public opinion analysis, multidimensional audience opinion measurement, audience cognitive law discovery, and supervision/control.

Keywords: network public opinion field; information measurement; sentiment analysis; measurement mechanism and path

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