

Identifying Key Determinants of Open Government Data Readiness: A Case Study of Provincial-Level Local Governments (Postprint)

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Abstract

[Purpose/Significance] Preparedness for government data openness denotes the degree of perfection in preparations undertaken to provide higher-value data to society. This study investigates the differential influencing factors affecting local government data openness preparedness and proposes corresponding advancement pathways, aiming to foster sustainable data openness practices. [Method/Process] Employing qualitative comparative analysis (QCA), this research utilizes policies pertaining to data openness preparedness of 13 provincial-level governments as study samples to analyze the “joint effects” of multiple factors influencing government data openness preparedness and the “interactive relationships” among these factors. [Results/Conclusions] The findings indicate that security assurance constitutes a necessary condition for government data openness preparedness. Four elements—data management, data utilization, departmental responsibilities, and security assurance—must be simultaneously present. Textual effectiveness and public leadership support function as auxiliary conditions that are employed in combination with the elements of data management, data utilization, security assurance, and departmental responsibilities.

Full Text

Identification of Key Influencing Factors of Government Data Openness Readiness: A Case Study of Provincial Local Governments

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Abstract: [Purpose/Significance] Government data openness readiness refers to the degree of perfection in preparations for providing higher-value data to society. Examining the differential factors that influence local government data openness readiness and proposing corresponding advancement pathways aims to promote the sustainability of data openness practices. [Method/Process] Using qualitative comparative analysis (QCA), this study takes the readiness policies of 13 provincial governments as research samples to analyze the “combined effects” of various factors affecting government data openness readiness and the “interactive relationships” among these factors. [Result/Conclusion] The study finds that security assurance is a necessary condition for government data openness readiness. Four elements—data management, data utilization, departmental responsibilities, and security assurance—must be present simultaneously. Textual effectiveness and public leadership support serve as auxiliary conditions that combine with data management, data utilization, security assurance, and departmental responsibility elements.

Keywords: government data openness; readiness; QCA; influencing factors
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Government data openness involves providing structured, machine-readable datasets generated by governments to stakeholders for download, access, and utilization to achieve social and economic benefits [1]. In 2009, the global government data openness movement began, with countries such as the United Kingdom, the United States, and Canada actively introducing relevant policies and measures to promote government data openness practices. How to effectively open government data to the public has become a strategic development issue for countries worldwide. In August 2015, China’s State Council issued the “Outline for Promoting Big Data Development,” explicitly stating that big data has become a new approach to enhancing government governance capabilities, and that big data technology should be used to promote government data openness and sharing to tap into and realize the potential value of data resources [2]. Government data openness was frequently mentioned at the 2019 Two Sessions and has been included in China’s “Ten Key Projects” for big data development [3]. With the rise of new-generation information technologies represented by “Internet+” such as the Internet of Things, big data, blockchain, and artificial intelligence, the breadth and depth of government data openness need to be further expanded.

Readiness refers to the preliminary preparations made for achieving open data [5], including four aspects: whether comprehensive policies and protocols have been formulated to ensure long-term data availability, whether a foundation has been laid for governments at all levels to utilize open data, whether citizens and civil society groups use open data to participate in policy-making, and whether enterprises and entrepreneurs fully exploit the economic opportunities brought by open data. Readiness, implementation, and impact represent different stages of government data openness development, with interconnections among these

dimensions. Simply put, adequate readiness in the early stage guarantees implementation in the mid-stage, high implementation enhances the impact of government data openness in the later stage, and increased impact in turn further promotes readiness and implementation [6]. Readiness is the foundation and prerequisite for government data openness, measuring the initiatives and implemented policies that governments adopt for open data. The higher the readiness in a given location, the better the effects at the data, platform, and utilization layers.

Overall, China's government data openness is still in its initial development stage, where readiness is particularly important. Current research has been limited to overall assessments of government data openness readiness, without discussing which combinations of elements can more effectively promote readiness. This study addresses this gap by taking eight influencing factors of government data openness readiness—textual effectiveness, data management, data utilization, security assurance, departmental responsibilities, public leadership support, annual work plan publication, and standard specifications—as antecedent condition variables, and the readiness indices of 13 provincial local governments as the outcome variable. Using Qualitative Comparative Analysis (QCA), this paper examines the relationships between condition and outcome variables from a multi-cause perspective, identifies the key elements or element combinations that enhance local government data openness readiness, and explores pathways for improving the foundation of China's government data openness readiness and its enhancement.

1 Research Method, Sample Selection, and Variables

1.1 Research Method

In 1987, R. Charles first proposed the Qualitative Comparative Analysis (QCA) method [9], which is based on set operation logic of “AND,” “OR,” and “Negation” [10]. By comparing and analyzing multiple causal conditions across cases and combining case-oriented approaches, QCA seeks multiple concurrent causal relationships and configurations between explained and explanatory variables, aiming to identify and explain the antecedent conditions and their combinations that lead to a particular outcome. Clear-set QCA (csQCA), developed by R. Charles and D. Kriss, was the first QCA technique [11], essentially a tool for “simplifying complex data structures in a logical and holistic manner.” csQCA requires converting condition and outcome variables into dichotomous variables with values of 0 and 1. To date, csQCA remains the most widely used QCA technique [12].

The main reasons for adopting csQCA in this study are: (1) Traditional empirical methods require large sample sizes and can only verify relationships between individual variables and the outcome variable, handling only symmetrical relationships (if $A \rightarrow B$, then $A \leftarrow B$). Empirical methods cannot reveal interactive relationships among factors influencing government data openness readiness.

(2) QCA requires 10-60 samples, making it suitable for medium-small case analysis. Using readiness data from 13 provincial governments as research samples meets this requirement. (3) This method employs Boolean algebra operations to handle asymmetric causal relationships and derives the most explanatory antecedent condition configurations through consistency and coverage parameters, enabling analysis of complex, non-linear causal relationships between condition and outcome variables.

The factors influencing high readiness for government data openness are multiple and concurrent. Using this method helps identify and explain the relatively effective and ineffective factors for government data openness readiness in different regions, thereby summarizing condition combinations for improving the foundation of China's government data openness readiness.

1.2 Sample Selection

In September 2015, the State Council issued the “Outline for Promoting Big Data Development,” officially launching China's government data openness initiative, which has since made positive progress. Since some provinces, autonomous regions, and municipalities did not introduce targeted policies on government data openness between 2015 and 2019, and considering the readiness index rankings in the “2019 China Local Government Data Openness Report,” this study selected 13 provincial-level administrative regions including Shanghai, Zhejiang, Guizhou, Beijing, and Fujian as examples. Descriptive statistical analysis and text analysis were conducted on their relevant laws, regulations, policies, opinions, standards, and news reports.

Data collection methods were as follows: (1) From “PKULaw”—China Legal Research System, statistical yearbooks, and provincial government portals and data openness platforms, full-text searches were conducted using “data openness,” “data sharing,” and “data openness and sharing” as keywords to obtain relevant policies, primarily in the form of “XX Municipal Public Data Openness Management Measures (Draft),” “XX Provincial Government Data Resource Management Interim Measures,” and “XX Provincial Public Data and E-Government Management Measures.” (2) Search engines were used with terms such as “government data,” “openness,” “sharing,” “standards,” and “planning” to retrieve relevant laws and regulations, provincial local government annual work plans for data openness, and news reports on leadership support. Data collection concluded in December 2019. presents sample data sources (partial). Note that some provincial governments have formulated specialized data openness standards but fall outside this study's timeframe, such as Shandong Province's “Public Data Openness Technical Specifications” and “Public Data Openness Metadata Specifications” published in October 2020, and Zhejiang Province's “Interim Measures for Public Data Openness and Security Management” published in June 2020.

1.3 Variable Determination

1.3.1 Outcome Variable Measuring government data openness readiness is a complex issue. The “China Open Data Index” and “China Local Government Data Openness Report” are China’s first professional indices and reports dedicated to evaluating government data openness levels. This study adopts the readiness index from the “2019 China Open Data Index” to reflect the degree of government data openness readiness, using it as the outcome variable. The index was sorted in descending order and assigned values based on the median: 1 for values at or above the median, and 0 for those below. Specific data are shown in .

1.3.2 Condition Variables Condition variables are a critical component of QCA and must be determined following certain theories and methods. Domestic research on government data openness readiness is limited. Using CNKI, Wanfang, and VIP databases, this study conducted searches on government data openness combined with “readiness” in themes, titles, and keywords until November 2020, yielding 27 relevant papers after removing irrelevant and duplicate articles. Given the limited domestic research, this study employed literature induction based on existing research frameworks to determine antecedent conditions for government data openness readiness.

As mentioned earlier, the ODB’s open data readiness assessment is closely related to policies. Currently, the China Open Data Index evaluation expert committee has constructed a government data openness readiness analysis framework based on fundamental principles of data openness, employing a cross-disciplinary, multi-disciplinary, third-party, and neutral professional perspective grounded in China’s national conditions and data openness practices. Its key elements include: textual effectiveness, content requirements, departmental responsibilities, public leadership support, annual work plan publication, standard formulation, and standard specificity. Based on this “typical framework,” this study made appropriate adjustments through induction, screening, integration, and reconceptualization of variables.

The specific operations were as follows: (1) Government data openness readiness standards refer to normative documents developed through consensus and approved by recognized institutions to achieve optimal order within a certain scope. Among the 13 provincial-level regions, only Guangdong and Shandong have formulated specialized data openness standards, while Guizhou’s regulations involve data openness content. As China’s government data openness is still developing, standard specifications are not yet mature. Therefore, “standard formulation” and “standard specificity” were unified as “standard specifications.” (2) Relevant policies and regulations form the basic guarantee for government data openness and sharing. The “textual effectiveness” indicator was examined from the level and specificity of laws, regulations, and policy documents. The original “text content” core element was split into government data management, data utilization, and security assurance. (3) The organiza-

tion and implementation of government data openness readiness refer to the need for effective management systems, leadership support, and work plans, mainly including the level of competent departments and related departmental responsibilities, public leadership support, and whether annual work plans are published. Analysis of policy texts and relevant literature reveals that departmental responsibilities include the division of responsibilities between government data openness competent departments and related departments, forming the organizational foundation for ensuring data openness work. Public support from local senior leaders facilitates smooth data openness implementation. Developing and publishing annual data openness work plans helps government departments clarify phased goals and tasks, provides clear expectations for data users, and accepts social supervision. Departmental responsibilities, leadership support, and annual plan publication primarily examine the organizational and implementation readiness of government data openness.

Through analysis and induction, eight influencing factors of local government data openness readiness were identified: textual effectiveness, data management, data utilization, security assurance, departmental responsibilities, public leadership support, annual work plan publication, and standard specifications. These eight key elements constitute the core content of the 13 provincial local governments' data openness readiness and can serve as condition variables for further exploration of their influencing mechanisms.

2 Variable Assignment

After determining condition and outcome variables, sample data were manually screened, summarized, and analyzed for unified variable selection and explanation. presents the condition and outcome variable settings.

- (1) **Textual effectiveness** was examined from two aspects: the level and specificity of laws, regulations, and policy documents. Based on relevant laws, regulations, and policy documents released on local government portals and data openness platforms, these can be categorized into local regulations, local government rules, normative documents, and plans/opinions. For instance, Guizhou, Tianjin, and Hainan have enacted local legislation on government data openness, Shanghai issued the “Shanghai Municipal Public Data Openness Interim Measures,” Guangdong promulgated relevant normative documents, and Beijing issued departmental normative documents on transportation data. As of December 2019, none of the 13 provincial-level regions had enacted specialized local regulations, rules, or normative documents specifically for data openness. Existing regulations and policies primarily address public data resource sharing, openness, management, and big data development promotion. Only Shanghai formulated specialized local government rules and released the “Shanghai Municipal Public Data Openness Classification and Grading Guide (Trial)” as a plan/opinion. This study sorted through existing regulations and policies from the 13 provincial-level regions, assigning 1 to those with

at least one section specifically addressing government data openness or specialized regulations, policies, and plans for data openness, and 0 otherwise.

- (2) **Data management** primarily involves managing open data resources. By analyzing local regulations, government rules, normative documents, and plans/opinions on government data openness from the 13 regions, those including data management content such as open data scope, open data catalogs and lists, and open data quality were assigned 1. For example, Chapter 6 “Data Openness” of the “Guizhou Provincial Government Data Resource Management Interim Measures” stipulates that “government data shall be managed according to three categories: unconditional openness, application-based openness, and legally non-openness,” and requires “compiling a negative list for data openness” and “strengthening dynamic update management of open data to ensure timeliness and effectiveness.” Otherwise, the value was 0.
- (3) **Data utilization** is the fundamental purpose of data openness. Utilizing open data improves government transparency and efficiency and encourages social innovation. China has not yet enacted national-level laws and regulations on government data utilization. Related policies are primarily directional texts such as opinions, regulations, and plans. During the data collection period, only Guizhou, Tianjin, and Hainan explicitly standardized government data utilization through local legislation, such as the “Guizhou Province Big Data Development and Application Promotion Regulations,” “Tianjin Municipality Big Data Development and Application Promotion Regulations,” and “Hainan Province Big Data Development and Application Regulations.” Additionally, provincial local governments developed public services using open data to promote industry data resource mining and integration, such as Beijing’s “Transportation Travel Data Openness Management Measures (Trial)” issued in November 2019. Such content was assigned 1, and 0 otherwise.
- (4) **Security assurance** includes two aspects: strengthening laws and regulations on data use, security, and privacy, and establishing safeguard mechanisms for personnel, funding, etc. to ensure data openness promotion [17]. Statistical analysis of laws, regulations, policies, and plans related to data openness from various regions assigned 1 to those explicitly containing security assurance content, and 0 to those not mentioning data use security assurance.
- (5) **Departmental responsibilities** refer to the division of responsibilities between government data openness competent departments and related departments. Government data openness requires specialized data management departments and personnel responsible for overall planning and implementation [18]. Among the 13 regions, those with specific and clear provisions on departmental responsibilities in “data openness” related regulations and policies, such as Zhejiang’s establishment of a Big Data De-

velopment Administration Bureau with 明确规定 “responsible for compiling public data resource catalogs and openness catalogs... promoting interconnection of information systems across departments and levels” [19], were assigned 1, and 0 otherwise.

- (6) **Public leadership support** refers to support from senior local leaders (such as party committee secretaries, governors, mayors, etc.) that powerfully advances government data openness. Speeches explicitly addressing data openness experiences, problems, significance, and requirements were assigned 1, such as Fujian Provincial Party Committee Standing Committee member and Executive Vice Governor Zhang Zhina’s speech on January 12, 2019, at the launch ceremony of Fujian’s public information resources unified openness platform and Maritime Silk Road satellite data service center, emphasizing the deep integration and utilization of data with the Internet, big data, artificial intelligence, and the real economy [20]. Speeches with broad content or only mentioning the need for new progress in data openness were assigned 0.
- (7) **Annual work plan publication** involves developing and publicly releasing annual data openness work plans to clarify phased goals for government departments, provide clear expectations for data users, and accept social supervision. Shanghai has developed and published the “Annual Work Plan and Key Areas for Government Data Resource Social Openness” since 2014. Those with explicitly published annual work plans were assigned 1, and 0 otherwise.
- (8) **Standard specifications** were screened based on whether detailed open data standard specifications and operation guidelines had been formally issued and implemented. Industry-specific standards were excluded from the study. For example, Shandong formulated “Basic Requirements,” “Data Desensitization Guidelines,” and “Openness Evaluation Indicator System” for public data openness at all levels of government departments [21]; Guangdong issued the “Data Openness and Sharing Series Standards,” including “Government Information Resource Identification Coding Specification” (DB44/T2109-2018), “E-Government Data Resource Openness Technical Specification” (DB44/T2110-2018), and “E-Government Data Resource Openness Management Specification” (DB44/T2111-2018) [22]. Those with formally issued and implemented standards specifically for government data openness were assigned 1, and 0 otherwise.

3 QCA Single-Variable Necessity Analysis and Condition Combination

3.1 Single-Variable Necessity Analysis

QCA single-variable necessity analysis primarily determines whether a relationship of sufficiency and necessity exists between condition and outcome variables by calculating consistency and coverage. The necessity analysis of individual variables influencing government data openness readiness is shown in .

The consistency indicator is used to determine whether a condition (or condition combination) is a necessary or sufficient condition for the outcome variable. The formula for necessary conditions is:

$$\text{Consistency}(Y_i \leq X_i) = \sum \min(X_i, Y_i) / \sum(Y_i) \quad (1)$$

Generally, when the consistency indicator exceeds 0.8, the condition can be considered necessary for the outcome. After consistency is satisfied, the coverage indicator is further analyzed by calculating the intersection of condition and outcome variables to measure the estimated scope of the outcome explained by a condition. This indicator describes the explanatory power of condition (or condition combination) X on outcome Y. A higher coverage indicator indicates stronger explanatory power of X on Y.

In the necessity test with outcome variable “outcome=1” (high government data openness readiness), the consistency values for data management, data utilization, and security assurance exceed 0.8, indicating these three condition variables are necessary conditions for the outcome. In the coverage test, the coverage rates for data management, data utilization, and security assurance are 0.64, 0.67, and 0.58 respectively, all below 0.8, indicating relatively weak explanatory power.

In the necessity test with outcome variable “~outcome=1” (low readiness), the consistency values for data management and data utilization are below 0.8, while security assurance’s consistency exceeds 0.8, indicating that data management and data utilization as individual antecedent conditions are insufficiently necessary, whereas security assurance is sufficiently necessary.

3.2 Condition Combination Consistency and Coverage Analysis

Using QCA analysis software for Boolean minimization of the truth table, the results yield three solutions oriented toward low and high readiness: complex solution, parsimonious solution, and intermediate solution. The parsimonious solution produces overly simple conclusions with limited insight, while the intermediate solution provides more representative explanations that neither rigidly follow variable settings nor violate case facts, offering better enlightenment and generalizability. This study adopts the intermediate solution for explanation, as shown in .

reveals that for outcome variable “1,” the consistency of all five combinations and the overall consistency value are “1,” with an overall coverage of 0.86. The raw coverage of A1, A2, A3, and A4 is 0.29 (these four combinations have similar explanatory power), representing the four combinations with the highest coverage and typical combinations for high government data openness readiness: (1) Textual effectiveness \times Data management \times Data utilization \times Security assurance \times Departmental responsibilities \times ~Annual work plan publication \times ~Standard specifications; (2) Data management \times Data utilization \times Security assurance \times Departmental responsibilities \times Public leadership support \times ~Annual work plan publication \times ~Standard specifications; (3) Textual effectiveness \times Data management \times Data utilization \times Security assurance \times Departmental responsibilities \times Public leadership support \times ~Standard specifications; (4) Textual effectiveness \times Data management \times Data utilization \times Security assurance \times Departmental responsibilities \times Public leadership support \times ~Annual work plan publication.

4 Research Results and Development Recommendations

Through analysis of the variable compositions in groups A1, A2, A3, and A4, we can identify close relationships between differences in government data openness readiness and different combinations of condition variables:

- (1) In single-variable necessity testing, security assurance is an indispensable condition for high government data openness readiness, involving government data security and privacy protection, primarily relying on laws, regulations, policies, and standards to regulate government data openness. Its presence in all A1-A5 combinations demonstrates its extremely important role in promoting government data openness readiness.
- (2) In combinations A1-A4, the four elements of data management, data utilization, security assurance, and departmental responsibilities appear simultaneously, indicating all four condition variables are important and must be present together to jointly promote government data openness preparation work.
- (3) Comparative analysis reveals alternating and coexisting patterns between textual effectiveness and public leadership support, suggesting neither has a significant independent impact on the outcome variable. Instead, they function as auxiliary conditions in different combinations alongside data management, data utilization, security assurance, and departmental responsibilities to produce different readiness outcomes.
- (4) The elements “annual work plan publication” and “standard specifications” appear as “~annual work plan publication” (absence of annual plan publication) and “~standard specifications” (absence of standard specifications) in three of the four high-readiness combinations (A1-A4), indicating these two factors can be absent in high-readiness combinations. QCA results show these two conditional factors do not have significant promoting

effects in government data openness readiness.

Based on these conclusions and China's government data openness practices, the following recommendations are offered:

- (1) **Strengthen the influence of data management, data utilization, and security assurance on government data openness readiness.** Government data openness is largely supply-driven. Data management runs through every stage of data flow, ensuring normal and efficient data operation, involving open data scope, catalog and list compilation, open data quality management, and openness method requirements [23]. Data utilization should formulate corresponding laws and regulations to eliminate enterprise and individual concerns about data collection and open utilization, better achieving data openness and utilization. Various methods should be encouraged across regions, such as competitions to promote data utilization or building “maker space” data application innovation service platforms [24]. Open government data involves state secrets, personal privacy, and commercial confidentiality; security assurance is an important foundation for the long-term, sustainable development of data openness [25], requiring not only strengthened laws and regulations on data use, security, and privacy but also safeguard mechanisms such as personnel capacity and funding guarantees. Experience at home and abroad shows that clear and explicit government data openness laws and regulations are the legal foundation and important basis for promoting government data openness. Data management, data utilization, and security assurance are both important and specific contents of government data openness laws and policies. Currently, national-provincial-municipal open data resource policy frameworks and implementations have initially taken shape, with a series of policies and laws introduced using “proactive” incentive approaches, such as Shanghai’s “Implementation Opinions on Promoting Government Information Resource Openness and Utilization” [26] and Zhejiang’s “Interim Measures for Public Data Openness and Security Management” [27]. However, related content remains relatively general, with only some localities like Tianjin explicitly requiring open data catalog and list compilation, or only some regions like Guizhou clearly specifying pre-openness data review. Therefore, future formulation of government data openness laws and regulations should enhance the detail and clarity of data management, data utilization, and security assurance content.
- (2) **Emphasize the combined effects of condition elements.** The analysis concludes that textual effectiveness, public leadership support, and departmental responsibilities are closely related and complementary to data management, data utilization, and security assurance. For example, textual effectiveness represents the binding force of laws and policies, which is closely linked with data management, data utilization, and security assurance content, as seen in Guizhou’s “Guizhou Provincial Government Data Resource Management Interim Measures” [28] and Tianjin’s

“Tianjin Municipality Big Data Development and Application Promotion Regulations” [29], which provide clear provisions and requirements for open data governance, openness methods, utilization promotion, security protection, and safeguard mechanisms. Public leadership support and departmental responsibilities relate to the organization and implementation of government data openness, which also has close connections with data management, data utilization, and security assurance. Therefore, local governments should pay attention to the combined effects of various condition elements in their data openness preparation work to enhance effectiveness.

- (3) **Explore the positive roles of “annual work plan publication” and “standard specifications.”** Data analysis alone suggests these elements do not yet have significant promoting effects on government data openness readiness. However, practice shows that Guangdong and Shandong have formulated specialized local standards, further standardizing and institutionalizing government data openness practices. Shanghai has continuously developed and published specialized annual work plans for government data openness, such as the “2020 Shanghai Municipal Public Data Resource Openness Annual Work Plan” [30], which publicly announces key areas for Shanghai’s public data openness from three aspects: overall objectives, key tasks, and work requirements and safeguards, particularly prioritizing “epidemic prevention and resumption of work” to ensure comprehensive economic recovery post-COVID-19. With overall weak foundations in government data openness readiness, the impact of annual plan publication and standard specifications on local government data openness work remains unclear and requires further exploration.

5 Research Conclusions

This study used the government data openness readiness indices of 13 provincial-level local governments including Guizhou, Shanghai, Tianjin, and Fujian as outcome variables and influencing factors of provincial local government data openness readiness as condition variables. Using Qualitative Comparative Analysis (QCA) to compare various combinations of condition variables, the study found that among factors influencing government data openness readiness, security assurance is a necessary condition. Four elements—data management, data utilization, departmental responsibilities, and security assurance—must be present simultaneously. Textual effectiveness and public leadership support serve as auxiliary conditions that combine with data management, data utilization, security assurance, and departmental responsibility elements, while annual plan publication and standard specification elements do not have significant promoting effects in government data openness readiness and require further exploration.

Admittedly, csQCA analysis can only handle dichotomous variables, requiring both condition and outcome variables for government data openness readiness

to be calibrated as 0 or 1, where 1 indicates membership in the set and 0 indicates non-membership. This process inevitably involves some subjectivity in case categorization. Additionally, this study focused on provincial-level local governments; future research could expand the sample scope to include municipally-level cities with outstanding data openness readiness performance (such as Guiyang, Jinan, and Chengdu) to adjust and deepen the practical guidance of research conclusions for government data openness.

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

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