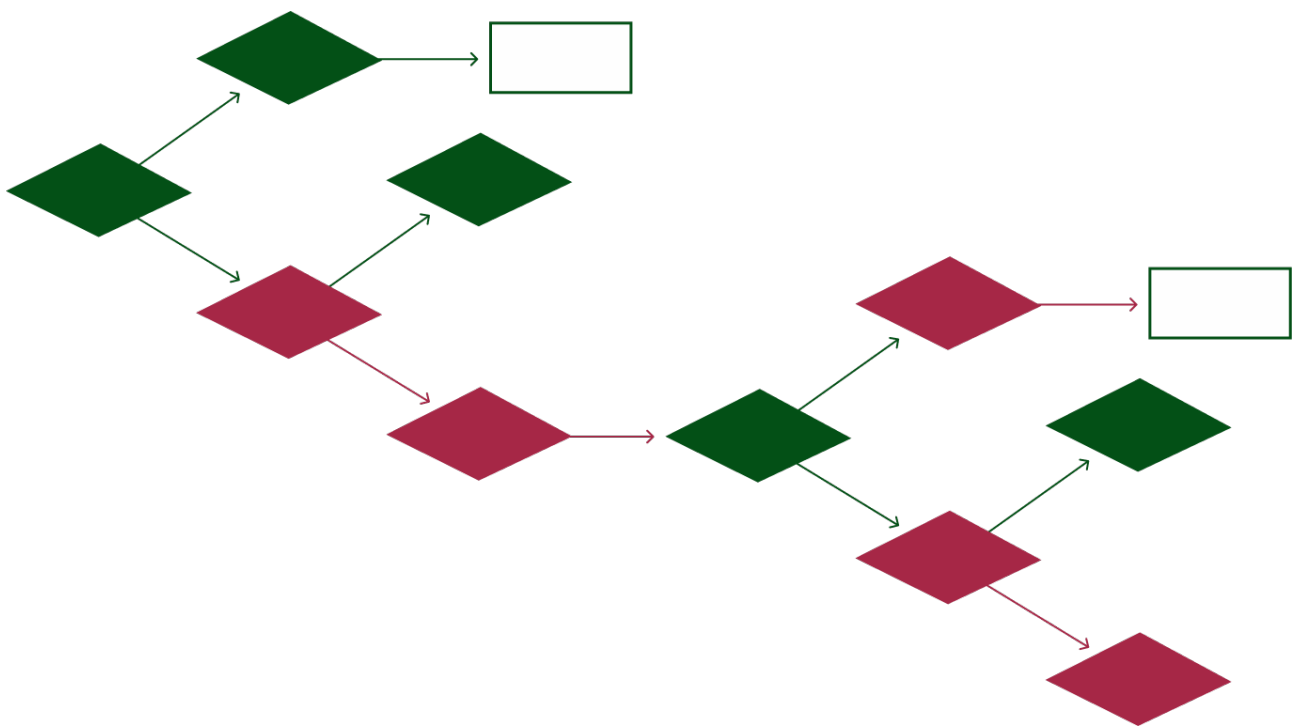


An Information Design Approach to the Special Taxation Measures Act (STMA)

租税特別措置法に対する情報デザインアプローチ



Master's Degree in Communication Design

Visualizing the Complexity of Japanese Tax Law

**An Information Design Approach to the Special Taxation
Measures Act (STMA)**

Author: Kanna Asano - 11030929

Supervisor: Michele Mauri

Politecnico di Milano

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Master's Degree in Communication Design

Sommario

Questa ricerca sintetizza la dottrina giuridica con il design dell'informazione per decostruire l'iper-complessità e l'asimmetria informativa della Legge sulle Misure Fiscali Speciali giapponese (STMA). Alimentata da consolidati interessi socio-economici, questa legislazione temporanea si è sviluppata in un'intricata architettura frammentaria, imponendo severe barriere cognitive a cittadini e studenti di materie giuridiche. Per affrontare tale sfida, lo studio propone un framework di legal design a due livelli ottimizzato per gli "studenti di materie giuridiche", identificati come intermediari chiave dell'interpretazione. Il framework sviluppa un modello *Macro-View* (diagrammi a bolle) basato su un punteggio quantitativo dei riferimenti (*Impact Score*) per esporre i colli di bottiglia sistemici, e due modelli *Micro-View* (diagrammi di flusso e storyboard) per visualizzare scenari pratici, applicati all'Articolo 41 della STMA (Detrazione per i Mutui Edilizi).

La valutazione empirica (n=13) ha dimostrato che gli ambienti supportati da ausili visivi producono un aumento approssimativo del 20% nell'accuratezza della risoluzione dei problemi rispetto ai controlli basati solo sul testo, riducendo significativamente l'affaticamento mentale e aumentando la fiducia degli utenti. L'analisi qualitativa evidenzia una chiara divergenza funzionale: i diagrammi di flusso fungono da presidio cognitivo per navigare tra rami decisionali cronologici e condizionali, mentre le storyboard promuovono un'empatia contestuale attraverso la rappresentazione di dinamiche socio-istituzionali reali, liberando l'utente da interpretazioni rigidamente letterali.

Lo studio offre un valore teorico esternalizzando l'essenza non lineare del diritto e definendo il legal design come infrastruttura cognitiva per l'interpretazione normativa. Praticamente, questo approccio data-driven supporta l'Evidence-Based Policy Making (EBPM) e rafforza l'autonomia informativa dei contribuenti. L'integrazione tra design e giurisprudenza catalizza un cambio di paradigma verso una comunicazione fiscale intuitiva, rendendo i quadri normativi accessibili a tutti i cittadini, indipendentemente dal loro background giuridico.

Parole Chiave

Legal Design, Visualizzazione dell'Informazione, Educazione Giuridica, Diritto Tributario

Abstract

This research synthesizes legal scholarship with information design to deconstruct the hyper-complexity and information asymmetry of the Japanese Special Taxation Measures Act (STMA). Driven by entrenched socioeconomic interests, this temporary legislation has expanded into a complex patchwork architecture, imposing severe cognitive barriers on both citizens and legal learners. To address this challenge, this study proposes a two-layered legal design framework tailored for legal learners as crucial intermediate gatekeepers. The framework consists of a *Macro-View* model (bubble diagrams) driven by a quantitative reference-scoring logic (*Impact Score*) to expose systemic bottlenecks, and two *Micro-View* models (flowcharts and storyboards) to visualize practical statutory applications, using STMA Article 41 (Housing Loan Tax Credit) as a primary case study.

An empirical evaluation (n=13) demonstrated that visual-assisted environments yielded an approximate 20% increase in problem-solving accuracy compared to text-only controls, while significantly reducing subjective mental fatigue and increasing user confidence. Qualitative analysis revealed a definitive functional divergence between the visual modalities: flowcharts act as a cognitive safeguard for navigating chronological, conditional decision branches, whereas storyboards foster contextual empathy by representing real-world socio-institutional contexts, liberating users from rigid textual entrapment.

The study delivers theoretical value by externalizing the non-linear essence of law, establishing legal design as a cognitive infrastructure for statutory interpretation. Practically, this data-driven framework supports Evidence-Based Policy Making (EBPM) and reinforces taxpayer autonomy. Ultimately, integrating information design with jurisprudence catalyzes a paradigm shift toward intuitive tax communication, making complex regulatory frameworks accessible to all citizens regardless of their prior legal background.

Keywords

Legal Design, Information Visualization, Legal Education, Tax Law

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Chapter 1.

Introduction

Chapter 1.

Introduction

1-1. Problem Statement

The Act on Special Measures Concerning Taxation (commonly referred to as the Special Taxation Measures Act, referred to as "STMA"), enacted in 1957, is a Japanese statute that prescribes special tax treatments and exceptions regarding national taxes. While various definitions exist for special tax measures, Kaneko (2021) defines them as "measures designed to reduce or increase tax burdens when specific requirements are met in order to achieve certain policy objectives, despite taxpayers being in identical circumstances in terms of tax-bearing capacity and other factors." Primarily, special tax measures encompass both tax relief and tax increase measures to realize policy goals. However, as a policy-driven tax system, they generally manifest as tax relief measures, such as adopting tax exemptions or reductions as an alternative to granting direct subsidies. The STMA is the primary piece of legislation where most of these specific special tax measures are stipulated.

Every fiscal year, the contents of the STMA are reviewed in an integrated manner with the national budget formulation and the Fiscal Investment and Loan Program (FILP), serving as a core component of national fiscal expenditure methods. Although its legal status is that of a statute, the STMA substantially functions as an instrument for government economic intervention—similar to the budget and FILP—in that it exerts both macro- and micro-economic influences on the national economy.

Due to this unique legal character, despite the STMA being a form of temporary legislation (sunset legislation), the stipulated measures are repeatedly extended rather than expiring at their original deadlines, leading to the institutionalization of temporary measures. This institutionalization is considered a primary factor contributing to the excessive complexity of the STMA and the broader Japanese tax system. The Japanese government has attempted improvements through legislative actions, such as the enactment of the Act on Transparent Management of Special Taxation Measures (2010), and organizational restructuring, including the establishment of the Office for Reviewing Special Taxation Measures and Subsidies within the Cabinet Office in 2025. However, because special tax measures characterized by prolonged implementation and entrenched vested interests offer significant tax relief, they possess strong political stickiness, making substantial reform exceedingly difficult.

To date, extensive research has been conducted on the current state and challenges of special tax measures. However, most existing literature remains confined to analyzing the legal nature of the STMA or evaluating individual policy outcomes. In Japan, which adopts a self-assessment taxation system, the tax system directly affects the daily lives of citizens. Currently, there is a distinct lack of research that visualizes the complex statutory structure resulting from the institutionalization of these measures, or that serves as a bridge between legal content and public perception. This very structural complexity and the subsequent lack of accessibility constitute the true, underlying challenge facing the Japanese tax system.

1-2. Research Motivation

The author has been employed at the National Tax Agency (NTA) since 2019, engaging in the practical administration of tax affairs, including the examination of general tax rules and public relations to promote understanding of the taxation system. Through interactions with diverse stakeholders—including taxpayers, officials from other government ministries, and politicians—the author developed a profound awareness of the critical

shortage of effective methods for facilitating a comprehensive understanding of the complex tax system. Although administrative agencies regularly compile manuals and explanatory materials, the sheer density of technical jargon and the convoluted phrasing idiosyncratic to legislative texts mean that the process of simplifying these explanations itself demands immense labor. Furthermore, at the frontline of income tax return filing, many taxpayers abandon attempts to comprehend the underlying legal frameworks, choosing instead to entirely rely on tax officers to complete their filings. This tendency stems from the perception that the regulations are "too difficult to understand," compounded by a pervasive anxiety regarding penalties for erroneous filing. Consequently, this dynamic significantly undermines taxpayer autonomy.

This issue is further exacerbated by the current landscape of legal education in Japan. For individuals aspiring to become national civil servants, passing rigorous examinations in law or economics is required; however, tax law is notably excluded from the compulsory subjects. Similarly, on the National Bar Examination—the gateway for prospective lawyers, judges, and prosecutors—tax law remains merely one of eight elective subjects, chosen by a meager 5.2% of all candidates. Major bar examination preparatory institutions analyze this lack of popularity through several lenses: first, taxation is traditionally perceived as the specialized domain of certified tax accountants (*zeirishi*); second, few independent law firms specialize exclusively in tax matters, making it a less appealing choice from a practical career perspective; and finally, there is a severe shortage of instructional materials tailored specifically for the bar examination, as opposed to those designed for the tax accountant or certified public accountant examinations. In practice, because candidates who select tax law do not achieve a higher pass rate compared to those choosing other electives, the subject is generally perceived as "somewhat difficult" for examination strategies. In short, the current institutional reality in Japan restricts the means of learning tax law almost exclusively to official administrative publications or textbooks designed strictly for professional certification candidates.

Consequently, tax law is perceived as highly impenetrable by

both legal laypersons and legal students alike. The root cause of this alienation lies within the broader framework of traditional legal education, which heavily emphasizes the ability to interpret and analyze dense textual documents, such as academic theories and judicial precedents. Conversely, Niinikoski and Toivonen (2021) utilize concepts such as "human-centered design," "co-creation," and "empathy skills" to emphasize the growing necessity for more accessible and user-friendly legal outputs in education. They argue that because laws inherently require an effort to be comprehensively translated for the user, clear and effective communication is indispensable. Within the domain of legal design, visualization serves as a powerful instrument to clarify complex subject matters and efficiently convey legal information to end-users (Niinikoski & Toivonen, 2021).

Information design possesses the capacity to render intricate structures highly overviewable. It must be emphasized that the ultimate goal of fostering general taxpayer autonomy cannot be achieved without first addressing the educational barriers faced by those within the legal domain. If individuals with foundational legal training find tax law exceptionally impenetrable, it remains entirely inaccessible to the general public. Therefore, by establishing a pedagogical intervention specifically optimized for intermediate legal learners, this study seeks to dismantle the root cause of this systemic complexity. The author is firmly convinced that introducing the perspective of information visualization into traditional, text-dependent jurisprudence will provide vital auxiliary material for comprehending dense tax legislation, ultimately playing an essential role in bridging the communication divide.

1-3. Knowledge Objectives and Research Questions

The primary knowledge objective of this study is to establish a framework for intuitive legal visualization that clarifies the interaction between the STMA and other laws, specifically focusing on the Housing Loan Tax Credit as a primary case study for legal learners.

In this study, the target user group is broadly defined as "legal learners," regardless of their prior experience in tax law. This cohort encompasses a diverse spectrum of individuals with legal backgrounds, including law students and graduates, bar exam candidates from non-legal disciplines, and practitioners or administrative officers requiring continuous statutory learning. If visualization cannot resolve the structural bottlenecks that obfuscate comprehension for these highly literate learners, applying such frameworks to the general public remains impossible. Therefore, as an indispensable first step toward fostering general taxpayer autonomy, this study focuses on this intermediate layer to empirically validate the mechanism of cognitive load reduction. Furthermore, within the STMA, this thesis specifically concentrates on the Housing Loan Tax Credit under the individual income tax. This provision is selected because it directly impacts citizens' daily lives and engages an immense number of taxpayers during the annual tax filing period. To achieve these objectives, this study addresses the following three Research Questions:

1. What are the effective visualization methods for identifying structural complexities and cognitive bottlenecks in the STMA framework for legal learners?
2. How do logical flowcharts and narrative storyboards differ in their effectiveness for supporting the findability and comprehension of legal requirements when interpreting complex STMA provisions?
3. To what extent does a visualization framework improve a learner's ability to correctly interpret and apply STMA provisions to specific legal cases compared to traditional text-based methods?

Bridging jurisprudence and communication design, this thesis aims to visualize the underlying complexity of the STMA to reduce the cognitive load of legal learners. By demystifying provisions that challenge even literate learners, this study ultimately seeks to dismantle the persistent negative perceptions surrounding tax law and the broader taxation system.

1-4. Thesis Structure and General Methodology

This thesis is structured into seven chapters, systematically progressing from theoretical critique to framework application and empirical evaluation:

Chapter 2 ("The Structural Complexity and Information Asymmetry of STMA in Japan") analyzes the statutory composition and historical trajectory of the STMA to provide an overview of the structural challenges and information asymmetries learners encounter.

Chapter 3 ("Theoretical Background of Legal Visualization and Legal Education") reviews extant literature to examine the efficacy of information design in unraveling complex frameworks, classifies visualization methodologies, and explores their pedagogical potential in tax education.

Chapter 4 ("Methodology for Enhancing Legal Literacy: Design for Tax Education") identifies institutional bottlenecks within Japanese taxpayer education and defines the pedagogical significance of visualization as a design intervention to mitigate cognitive load.

Chapter 5 ("The Proposal: Visualizing the System and Logic of STMA") delineates the design and production methodologies for three visualization prototypes—bubble diagrams, flowcharts, and storyboards—utilizing Article 41 of the STMA for legal learners.

Chapter 6 ("Evaluation") evaluates these prototypes through a dual approach: a macro-view validation of methodological scalability and a micro-view empirical evaluation via Google Forms to verify improvements in comprehension and cognitive load reduction.

Chapter 7 ("Conclusion") summarizes the findings, synthesizes theoretical and practical contributions to jurisprudence and information design, and outlines prospective avenues for future work.

Chapter 2.

**The Structural Complexity and
Information Asymmetry of STMA
in Japan**

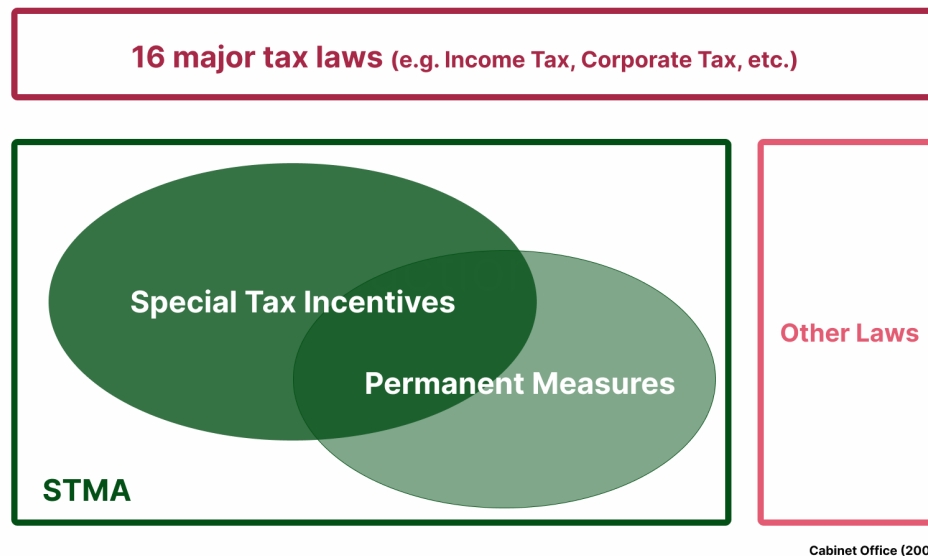
Chapter 2.

The Structural Complexity and Information Asymmetry of STMA in Japan

2-1. Legal Structure of STMA

While the STMA is a statute designed to prescribe special treatments and exceptions (special tax measures) regarding Japanese national taxes, its most defining characteristic is that it does not possess an independent, self-contained statutory hierarchy. Instead, it operates as a vast accumulation of "exceptions" superimposed onto existing "primary laws." Currently, the Japanese national tax architecture comprises 16 major tax laws, including the Income Tax Act, the Corporation Tax Act, the Consumption Tax Act, and the Inheritance Tax Act. The STMA executes cross-cutting interventions into these core statutory codes, functioning to suspend or modify their application under specific conditions. Notably, these special treatments frequently include measures with no specified expiration date (Figure 2-1) (Ida, 2025).

Consequently, grasping the exact total number of active special tax measures remains exceedingly difficult. Although one can individually count the modified provisions of the STMA following each annual tax reform, the resulting figures vary drastically depending on the aggregation definitions employed by different administrative sources (e.g., whether joint measures applicable



Cabinet Office (2009)

Figure 2-1. Conceptual diagram of cross-cutting interventions by the STMA into the primary tax statutes. (Compiled by the author based on data from the Cabinet Office, 2009).

to both income and corporate taxes are double-counted, or whether tax privileges outside the explicit boundaries of the STMA are included). The tax authorities themselves possess no standardized criteria for this aggregation. For instance, a 2009 Cabinet Office document reported the total number of special measures to be 310, whereas the Outline of Tax Reform (the fundamental policy framework for the following fiscal year's taxation) published in the exact same year cited "241 national tax measures and 286 local tax measures." Even when accounting for these systemic discrepancies in methodology, a 2026 Cabinet Secretariat document listed 431 active measures, indicating that an immense volume of "exceptions" has persistently remained entrenched over the past two decades. Scholars have pointed out that this normalization of exceptionalism causes systems originally intended as temporary mechanisms to become prolonged, chronic, and deeply institutionalized as political vested interests (Sato & Miyajima, 1990).

Regarding the mechanism through which the STMA alters primary tax laws, Kaneko (2021) argues that these measures not only compromise the principle of "tax equity" but fundamentally disrupt the logical coherence of the entire legal system. Special tax measures represent "policy-driven taxation" designed to steer socio-economic behavior toward specific governmental

objectives by reducing particular tax burdens. Since the sweeping Tax Reform of 1988, the Japanese taxation system has officially espoused three core principles: equity of burden, neutrality toward economic activities, and structural simplicity. However, as critics have highlighted, stitching special tax measures—which possess qualities akin to financial subsidies and pursue divergent goals such as investment promotion—onto a legal framework that ideally strives for equitable taxation inherently destabilizes the integrity of the tax system itself (Nakazato, 1991).

The unique irregularity of the STMA, characterized by these cascading chains of exceptions, is starkly mirrored in its statutory syntax. The STMA is characterized by a highly fragmented dynamic structural capacity, as evidenced by the dense proliferation of sub-articles, paragraphs, and items utilizing layered branch numbers (e.g., Article X-2, Paragraph X-3). Under normal circumstances, legislation should be constructed in a strict, logically sequential order. However, due to the exigencies of annual tax amendments, new statutory items and definitions are incrementally integrated into the preexisting intervals of established articles.

For instance, the text below is extracted from Chapter II (Special Provisions for the Income Tax Act), Section 1 (Interest Income and Dividend Income) of the STMA (English Edition), specifically focusing on the Special Provisions for Taxation on Interest on Book-Entry Transfer National Government Bonds:

Article 5-2(1) Where a nonresident or foreign corporation who satisfies the requirements specified in each of the following items for the category of bonds listed in the relevant item that are held thereby, receives payment of interest (excluding interest subject to the provision of Article 8 (1) or (2)) on book-entry transfer national government bonds prescribed by Article 88 of the Act on Book-Entry Transfer of Company Bonds, etc. (excluding coupon-only book-entry transfer national government bonds prescribed in Article 90 (3) of the said Act; hereinafter referred to in this Article as "book-entry transfer national government bonds") or local government bonds which shall be subject to the provisions of the said Act pursuant to Article 66 of the said Act as applied mutatis mutandis pursuant to Article 113 of the said Act (hereinafter referred to in this Article as "book-entry transfer local government bonds"), for which the nonresident or foreign corporation has made entries or records under the book-entry transfer system in his/her or its account established with a specified book-entry transfer institution, specified account management institution or specified indirect account management institution

(hereinafter referred to in this Article as a "specified book-entry transfer institution, etc.") or a qualified foreign intermediary, via a business office or any other office of the said specified book-entry transfer institution, etc. located in Japan (including a post office; hereinafter referred to in this Article as a "business office, etc.") or a specified overseas business office, etc. of the said qualified foreign intermediary, income tax shall not be imposed with respect to such interest to be received (limited to the part of interest equivalent to the amount calculated pursuant to the method specified by a Cabinet Order as the amount corresponding to the period during which the nonresident or foreign corporation has continued to hold the said book-entry transfer national government bonds or the said book-entry transfer local government bonds (limited to the period during which he/she or it has continued to hold entries or records under the book-entry transfer system regarding the said book-entry transfer national government bonds or the said book-entry transfer local government bonds; hereinafter referred to in this Article as the "holding period")):

Beneath this single, sprawling sentence lie 17 additional extensive items, each branching further into multi-layered informational hierarchies labeled with notations such as (1) or (a). Furthermore, to fully comprehend even a single provision like Article 5-2(1), a reader must simultaneously cross-reference and verify external definitions from cited legislations, such as the Act on Book-Entry Transfer of Company Bonds, etc.

Ultimately, the logical relationships within the STMA are severely fractured by the physical inflation of legislative texts and these cascading chains of external cross-references. To grasp even a single provision, a learner cannot understand the mechanism without referencing multiple distinct statutes and mentally reconstructing the overarching legal architecture. This extreme cognitive load required for statutory interpretation, combined with the sheer volume of special measures, serves as a primary barrier preventing taxpayers from comprehending both the STMA and the broader taxation system.

2-2. Political and Economic Background

Similar to the national budget and the Fiscal Investment and Loan Program (FILP), special tax measures are recognized as a primary instrument for government economic intervention. Due to this inherent nature, the complexity of the STMA and the issues surrounding these special measures have frequently stood at the center of political discourse and have been subject to continuous

review. This thesis examines the evolution of special tax measures across three distinct phases that represent major turning points in modern Japanese political history: the Democratic Party of Japan (DPJ) coalition government (2009), the second Abe administration (2012–2020), and the 2025 coalition government (2025–present).

In 2009, Japan experienced a historic change of government when an opposition party secured a single-party majority for the first time in the post-WWII era. The newly empowered DPJ pledged policies emphasizing "household support" and "politically-led" decision-making, which included rigorous initiatives to reform special tax measures. For instance, the government established the Project Team for Reviewing Special Tax Measures and Special Non-Taxation Measures (hereinafter referred to as the "Special Tax Measures PT") within the Government Tax Commission. The Special Tax Measures PT focused on clarifying the actual application status of these special tax privileges and organizing key discussion points to facilitate rigorous outcome verifications.

The report submitted by the Special Tax Measures PT in 2009 explicitly noted that special tax measures designed to reduce the tax burdens of specific entities constitute exceptions to the fundamental principle of tax equity. The report argued that to justify such measures, their actual application and policy efficacy must be rendered transparent and easily accessible so that taxpayers can fully comprehend and accept them. Recognizing that the actual utilization status of these measures had historically remained ambiguous and their legitimacy insufficiently verified, the Diet passed the Act on Transparency of Management of Special Taxation Measures (hereinafter referred to as the "Special Tax Measures Transparency Act") in 2010 based on the report's recommendations. Concurrently, a policy evaluation system specifically targeting special tax measures was established under the institutional framework of the Government Policy Evaluations Act.

In 2012, another transition of power occurred, marking the return of the Liberal Democratic Party (LDP) as the ruling party after three years and three months, and leading to the inauguration of the second Abe administration. This administration implemented a suite of economic policies collectively known as

"Abenomics," aimed at overcoming the economy's stagnation and revitalizing growth, which actively leveraged policy-driven taxation (Kamio, 2018). Government documents from 2014 recommended substantial revisions to special tax measures within corporate taxation, and the issue was prominently featured in the 2015 Outline of Tax Reform as a critical challenge facing the corporate tax system. The 2015 outline noted that while special tax measures can serve as effective policy mechanisms to achieve specific state objectives, they inevitably introduce distortions into the distribution of the tax burden. Consequently, the document emphasized the importance of restricting these privileges strictly to genuinely necessary areas, proposing a zero-based review—including outright abolition—for expiring measures by closely scrutinizing their necessity and policy outcomes based on actual utilization data.

Despite these pronouncements, new corporate tax privileges were progressively introduced following the launch of Abenomics, leading to a significant surge in the utilization of "tax credits" and "special deductions." This policy-driven approach heavily relies on various reserve systems and deductions to stimulate corporate behaviors under shifting economic conditions (Ganbo, 2025). During the 2015 Diet sessions, intense debates arose regarding the fact that policy-driven tax cuts through special measures, most notably the R&D tax credit, had essentially doubled under the Abe administration. Following subsequent cabinet shuffles and general elections, Shinzo Abe served continuously as Prime Minister until the Fourth Abe Cabinet (Second Reshuffled) in 2020. In the latter half of his nearly seven-and-a-half-year tenure, the administration attempted to balance the reduction of nominal corporate tax rates with the systematic reduction or elimination of lingering special tax measures.

In 2025, a major realignment of the ruling coalition occurred: the long-standing partnership between the LDP and Komeito was dissolved, and a new coalition government was established between the LDP and Nippon Ishin no Kai. In the Coalition Government Agreement signed by both parties during the formation of the administration, it was explicitly mandated to "conduct a comprehensive audit of special tax measures and high-value subsidies, and abolish those demonstrating low policy

efficacy." Following this coalition agreement, the Office for Reviewing Special Taxation Measures and Subsidies was formally established within the Cabinet Office in 2025. Official government documents stated that regarding special tax measures, the state would "implement targeted prioritization and enhanced incentives based on changing economic conditions and data-driven analysis," while simultaneously initiating a public call for proposals from citizens regarding the reform of these measures and subsidies. Furthermore, the 2025 Outline of Tax Reform reflected this perspective on the revision and rationalization of special measures, asserting that "to substantiate the efficacy and necessity of policies, appropriate data-based analysis and verification grounded in Evidence-Based Policy Making (EBPM) are indispensable."

As described above, while the policy imperatives of successive administrations have been continuously reflected in the STMA, the vast majority of these political and economic debates have tended to concentrate heavily on corporate taxation due to its substantial impact on national tax revenues. It is difficult to argue that sufficient discourse has been dedicated to reviewing measures directly impacting a broader base of taxpayers, such as individual income tax exemptions, or to addressing the structural complexity and resultant cognitive load imposed by the STMA syntax itself. However, the recent institutional shift toward EBPM within policy evaluation demonstrates that sophisticated data analysis is becoming a prerequisite for verifying statutory contents. Within this evolving context, visualizing statutory structures through the methodology of information design is gaining paramount importance as a critical infrastructure to support future legislative and public deliberations.

2-3. The Difficulty of Policy Evaluation

According to Sato (2020), a rigorous mechanism to verify the actual utilization and policy outcomes of special tax measures did not exist in Japan for a prolonged period. It was only after 2010 that formal methodologies for evaluating these policy-driven tax measures were systematically established. Currently, the primary

architecture for monitoring and verifying the STMA relies on two pillars: the reporting system governing actual utilization under the Special Tax Measures Transparency Act, and the policy evaluation framework mandated by the Government Policy Evaluations Act.

Under the Special Tax Measures Transparency Act, the primary targets of investigation are policy-driven tax measures that induce national revenue reductions, specifically within corporate taxation. When corporations file their corporate tax returns, they are required to submit a "Detailed Statement of Application" (Tekiyogaku Meisaisho) for any special measures utilized. The Ministry of Finance then aggregates these disclosures into the Report on the Results of the Investigation into the Application Status of Special Taxation Measures (hereinafter referred to as the "Statutory Report") and submits it to the National Diet. This Statutory Report delineates critical metrics, including the total number of applications, the number of participating corporations, the total amount of tax reductions, industrial sector breakdowns, and the specific amounts utilized by the top ten claiming corporations. The

頁	番号	制度名	区分	点検結果							
				(1) 達成 目標	(2) 過去の 適用数	(3) 将来の 適用数	(4) 過去の 減収額	(5) 将来の 減収額	(6) 過去の 効果	(7) 将来の 効果	(8) 他の政 策手段
内閣府											
18	内閣01	地方における企業拠点の強化を促進する税制措置の拡充及び延長	拡・延	A	A	A	A	A	A	A	A
42	内閣02	国家戦略特区における所得控除制度の延長	延長	A	A	A	A	A	B	C	A
50	内閣03	国家戦略特区における特別償却又は税額控除の延長	延長	C	A	A	A	A	C	D	A
62	内閣04	国家戦略特区における国家戦略民間都市再生事業に対する課税の特例措置の拡充・延長	拡・延	A	A	A	A	C	B	B	A
70	内閣05	国際戦略総合特区における特別償却又は税額控除の延長	延長	C	A	A	A	A	E	E	A
82	内閣06	地方創生応援税制（企業版ふるさと納税）の制度改善（適正化）に伴う所要の措置	一	A	A	A	A	A	A	A	A
90	内閣07	日本学術会議の法人化に伴う税制上の所要の措置	拡充	D	A	E	A	E	A	D	A
金融庁											
98	金融01	投資法人に係る税制優遇措置の見直し及び延長	拡・延	D	A	E	E	E	B	D	A
102	金融02	特定投資運用業者の役員に対する業績連動給与の損金算入の特例の拡充及び延長	拡・延	D	C	E	C	E	D	D	A
106	金融03	銀行等保有株式取得機構に係る資本割の特例措置の延長	延長	D	A	A	A	A	D	D	A
総務省											
114	総務01	株式会社海外通信・放送・郵便事業支援機構の法人事業税の資本割に係る課税標準の特例措置の創設	新設	A	—	A	—	A	—	A	A
文部科学省											
122	文科01	地元企業の地域学校協働活動への参加促進に向けた法人税の税額控除の創設	新設	C	—	A	—	C	—	C	A
厚生労働省											
130	厚労01	社会医療法人等が行う訪日外国人の自由診療に係る診療費要件の緩和	拡充	A	A	A	A	A	A	A	A
136	厚労02	社会保険診療報酬に係る事業税非課税措置の存続	延長	A	A	A	A	A	A	A	A
142	厚労03	医療法人の社会保険診療報酬以外部分に係る事業税の軽減措置の存続	延長	A	A	A	A	A	A	A	A
農林水産省											
152	農水01	環境負荷低減事業活動用資産等の特別償却	延長	A	A	A	A	A	B	B	A
160	農水02	輸出事業用資産の割増償却	延長	A	A	A	A	A	B	B	A
170	農水03	肉用牛の売却による農業所得の課税の特例	延長	A	A	A	A	A	A	B	A
経済産業省											
188	経産01	大胆な投資促進税制の創設	新設	E	—	E	—	E	—	E	E
192	経産02	地域経済に波及効果をもたらす国内投資の増加を目的とする産業用地整備の促進に向けた所要の措置	新設	C	—	C	—	E	—	E	A
196	経産03	特定事業活動として特別新事業開拓事業者の株式の取得をした場合の課税の特例の延長等	拡・延	B	A	A	A	A	B	E	A
206	経産04	海外投資等損失準備金制度の延長	延長	C	A	A	A	A	C	D	A
216	経産05	特定原子力施設が心等除去準備金の延長	延長	C	A	A	C	C	B	E	A
220	経産06	試験研究を行った場合の法人税額等の特別控除の拡充及び延長	拡・延	A	A	C	A	C	B	B	A

Figure 2-2. Sample pages from the *Results of the Inspection of Policy Evaluation Concerning Special Tax Measures* (Ministry of Internal Affairs and Communications, 2025).

2025 edition of the Statutory Report summarized the application status of 94 distinct special tax measures.

Complementing this, the policy evaluation framework mandates both ex-ante (prior) and ex-post (subsequent) evaluations by the relevant ministries regarding the corporate tax privileges monitored under the Special Tax Measures Transparency Act. Official guidelines delineating the specific parameters of these policy evaluations assert that the executing authorities must disclose objective datasets to the maximum extent possible, analyze the substantive content of the special measures, and ensure that these insights are effectively leveraged to inform broader tax policy deliberations.

Reflecting the government-wide transition toward Evidence-Based Policy Making (EBPM), this evaluation system assesses whether the "performance targets," "number of applications," "revenue reductions," and "policy efficacy" of each special tax measure are analyzed and explained based on objective data and empirical evidence (Figure 2-2). However, Sato (2020) criticizes these efforts, arguing that despite the accumulation of such administrative processes, it is difficult to maintain that substantial, meaningful outcomes have been achieved. This critique is supported by an inspection report published in 2025 by the Ministry of Internal Affairs and Communications (MIC)—which oversees the government's policy evaluations—which explicitly pointed out that the analytical explanations regarding both "historical efficacy" and "prospective outcomes" remained largely inadequate across ministries.

Scholars have identified profound institutional limitations inherent in these current mechanisms. Tatsuoka (2014) highlights that the published Statutory Reports represent a mere enumeration of raw datasets, devoid of the analytical aggregation and structural synthesis required from the perspective of systemic tax reform. Furthermore, Tanaka (2017) notes that due to the lack of unified accounting and reporting standards, the disclosed data fails to maintain structural consistency between the total number of individual tax items and their corresponding monetary values.

The most critical challenge, however, resides in the severe lack of informational accessibility. Statistical resources outside the narrow scope of the Special Tax Measures Transparency

Act—such as the data requested by the Committee on Budget of the House of Councillors—encompass a far broader array of measures, including individual income tax exemptions. However, because their operational boundaries diverge significantly from those of the Special Tax Measures Transparency Act, synthesizing a cohesive, overarching architecture of the entire tax system becomes exceptionally difficult for external researchers. Additionally, documents requested by the House of Councillors are difficult for the general public to retrieve from official online platforms (Tanaka, 2017). Consequently, the policy evaluation of special tax measures suffers from systemic deficiencies in both data quality and public accessibility.

In conclusion, although data collection from the perspective of EBPM continues to be executed, official public documents remain trapped in a mere presentation of numerical sequences, while advanced data analysis and conceptual synthesis remain fundamentally insufficient. Crucially, administrative agencies demonstrate a complete absence of information design principles in compiling these resources to facilitate taxpayer comprehension, leaving critical informational resources highly fragmented across disparate repositories. Despite acknowledged constraints on public information resources, concrete institutional initiatives to foster taxpayer understanding remain profoundly absent. Moving forward, it is indispensable not only to advance internal data analysis aligned with EBPM but to actively establish public disclosure methodologies rooted in data visualization, thereby empowering taxpayers to intuitively grasp both the structural architecture and the empirical effects of the taxation system.

2-4. Summary of Identified Challenges

Based on the comprehensive historical, political, and institutional analysis presented in this chapter, the systemic problems surrounding the STMA can be synthesized into the following three dimensions:

1. Structural Complexity

"Patchwork" Legislation: The continuous accumulation of statutory exceptions grafted directly onto primary laws has led to an uncontrollable surge in layered branch numbers (e.g., Article 5-2(1)(i)(a)[1]) and dense, internal parenthetical definitions (e.g., "hereinafter referred to in this Article...").

Cognitive Load Overload: These bloated and syntactically convoluted legal texts force taxpayers and legal learners to manually reconstruct the shifting legal hierarchies within their working memory, severely hindering any intuitive comprehension of statutory logic.

2. Informational Imbalance

Statistical and Definitional Inconsistency: The aggregate number of active special tax measures varies significantly depending on the administrative source and document, preventing a cohesive, transparent overview of the entire taxation system.

Corporate Tax Bias: Existing government evaluation systems and political debates focus almost exclusively on corporate taxation due to its high fiscal impact on national revenue. Consequently, individual income tax measures—which directly impact the vast majority of citizens—remain obscured within a pedagogical and institutional blind spot.

3. Accessibility and Visualization Gap

Raw Data Overload: Official publications and statutory reports consist solely of exhaustive numerical lists and raw tables. They completely lack information design principles or visual synthesis aimed at fostering intuitive public understanding.

Fragmented Information Resources: Essential legislative and budgetary documents remain highly scattered across disparate institutional repositories, making them difficult for ordinary taxpayers to locate (e.g., "data requested by the Diet is generally difficult to obtain via public websites" [Tanaka, 2017]).

Chapter 3.

**Theoretical Background of Legal
Visualization and Legal Education**

Chapter 3.

Theoretical Background of Legal Visualization and Legal Education

3-1. Structural Complexity and the Limits of Natural Language

According to Robinson (2009), traditional legal communication relies heavily on natural language, which functions as a linear medium requiring sequential information processing from the beginning of the text to the end. Robinson argues that law is fundamentally a regulatory system of rules prescribing legal effects dictated by specific conditions, with its subsequent conditions and effects entirely structured as forms of propositions. However, in response to socio-economic shifts and political imperatives, new statutory clauses and exceptional provisions are continuously grafted onto the preexisting legal framework. This incremental legislative process ultimately generates a multi-layered, patchwork architecture identical to the structural reality observed in the STMA (Figure 3-1). The STMA, in particular, exhibits highly dynamic and intricate dependencies, as its primary function is to temporarily suspend or modify the application of the 16 core tax statutes to achieve specific policy objectives. In short, the individual articles within the Japanese taxation framework cross-reference one another, culminating in a highly intertwined, non-linear network structure. Robinson critically

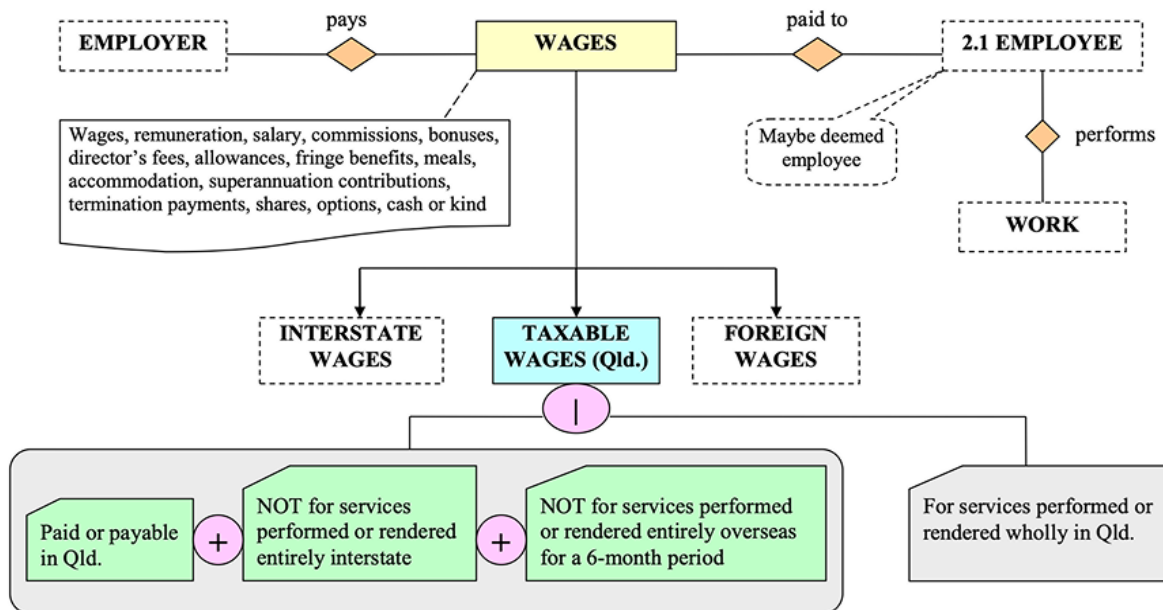


Figure 3-1. An example of the Logic Diagram based on Robinson's (2009) diagrammatic modeling language, which externalizes complex clausal logic through the simultaneous representation of conceptual relationships, hierarchical sub-classifications, and logical propositions.

analyzes this dynamic, emphasizing that legal professionals must expend immense intellectual effort during the cognitive process of reconstructing this non-linear logical architecture from purely linear texts. When individuals attempt to comprehend such convoluted legal texts, the working memory of the human brain encounters profound physiological limitations. Robinson (2009) observes that when legal texts utilize noun phrases that possess virtually no intuitive semantic meaning as pseudo-pronouns for broader expressions, assigning semantic value to these pronouns in accordance with grammatical rules becomes exceptionally difficult. Analytically translating this process into the cognitive dynamics of navigating the STMA reveals a significant bottleneck: readers must simultaneously retain the specific statutory requirements of a given article in their working memory, shift their visual and cognitive focus to the primary referenced tax statute, and mentally integrate the heavy, layered logic of an exception to an exception.

Focusing on online legal databases, Curtotti and McCreath (2012) argue that even in the highly digitized contemporary era, merely enhancing the textual searchability of legal repositories does not guarantee true information accessibility. Current online

legal databases represent a rudimentary form of statutory visualization by providing hyperlinks to related resources, such as subordinate regulations and judicial interpretations, alongside the primary statutory text. Some platforms even offer design enhancements to augment visualization, such as varied font sizes, strategic color selection, and optimized content layouts. However, Curtotti and McCreath contend that continuing to express the multi-dimensional relationships inherent in legal logic through a one-dimensional textual format constitutes a profound structural barrier that hinders the advancement of public legal literacy. Consequently, to comprehend highly complex statutory architectures, the traditional bottom-up approach of close textual reading has reached its absolute limit; a top-down visual overview that enables a spatial grasp of the overarching informational ecosystem has become an indispensable evolutionary phase. Notably, while acknowledging that practical applications of legal visualization are diversifying, they point out that the absence of a theoretical framework for the visualization of legislation is related to the broader problem in information visualization as a whole, thereby underscoring the urgent necessity of establishing a robust theoretical framework for visual design within the field of jurisprudence.

A pioneering methodology to quantify and visualize this structural complexity is the "Legislation Network," exemplified by the research of Koniaris et al. (2015) (Figure 3-2). Koniaris et al. constructed a comprehensive legislative network mapping the vast regulatory corpus of the European Union (EU) by defining individual statutory articles as nodes and the cross-referential connections between laws as edges. The paramount design significance of these "Law Maps" lies in their capacity to shift the user's perspective from a micro-level cognitive act—reading the contents of isolated provisions—to a macro-level vantage point: observing the global topology of the entire legal ecosystem. Through this approach, referential dynamics, such as how intensively a specific article attracts cross-references (degree centrality) or how isolated a particular legal domain remains, are explicitly presented as immediately recognizable visual patterns.

According to Koniaris et al. (2015), every document in the legal collection is analyzed for cross-references; if a cross-reference is

Hougaku) project developed by Koichiro Shibao (Figure 3-3). This project leverages information engineering methodologies to parse open-source legal datasets from the e-Gov legal search platform, visualizing cross-referential relationships between different statutes as an interactive network graph. By defining individual statutes as nodes and referential connections as edges (links), and dynamically adjusting node sizes based on their total reference count, the project enables users to intuitively perceive the structural importance and systemic influence of specific laws within the national legislative architecture. By manipulating these domain-specific network graphs, users can visually explore, for instance, which specific statute functions as the central hub within the national taxation sector. This project represents an invaluable domestic precedent that successfully implements the theoretical foundations of the legislation network established by Koniaris et al. within the Japanese statutory environment.

However, when evaluating the Japanese Law Visualization project specifically as a pedagogical tool for legal education, two critical challenges remain unfilled regarding the explicit objectives of this study. First, the scope of visualization is strictly confined to inter-statutory references—meaning act-to-act connections. It does not penetrate the intra-statutory domain, leaving the internal

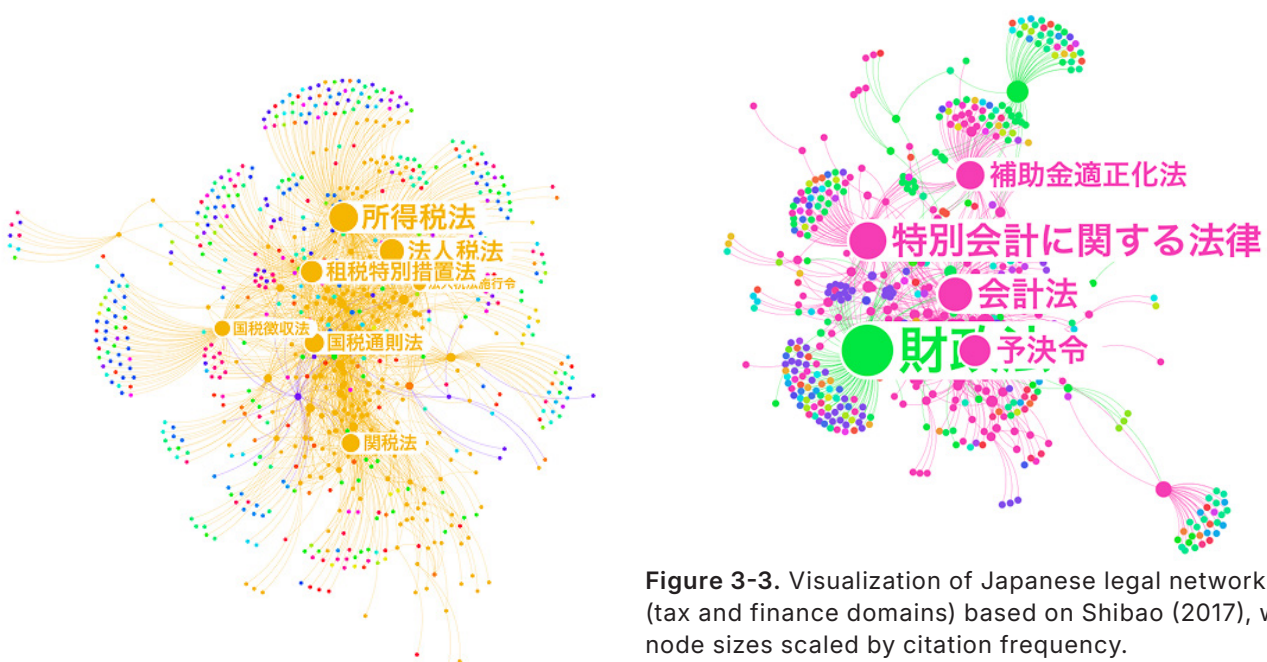


Figure 3-3. Visualization of Japanese legal networks (tax and finance domains) based on Shibao (2017), with node sizes scaled by citation frequency.

article-to-article connections and complex logical hierarchies completely unaddressed, which represents the most formidable barrier to understanding the STMA. Second, while the provided visual overview successfully demonstrates the global topology of the legal system, it lacks the instructional navigation functionality necessary to guide learners on how to systematically deconstruct individual articles and apply them to specific, real-world case scenarios.

Nevertheless, this macro-level methodology derived from network analysis remains highly potent for deconstructing the STMA. Within the Japanese taxation architecture, the STMA dynamically propagates countless exceptional referential links across the rigid, established foundations of primary tax laws. Analyzing this phenomenon through the lens of network theory reveals that the STMA acts as a disruptive intervention that fractures the logical consistency of core tax statutes, thereby driving the complexity of the entire systemic network to its absolute extreme. By adapting the methodologies of the legislation network, this study can present objective, visual evidence demonstrating not merely that the STMA is a collection of additive text, but precisely how it distorts the macro-topology of the broader tax system and consequently breeds profound information asymmetries. Ultimately, this foundational analysis validates the pedagogical efficacy of utilizing network visualization as a targeted educational approach for intermediate users—specifically, those possessing foundational legal knowledge—which will be discussed in subsequent sections.

3-2. Paradigm Shift in Legal Accessibility

The recent emergence of legal design challenges the traditional view of law as a static text to be deciphered, driving a fundamental paradigm shift that reimagines it as a dynamic interface utilized by users to achieve specific objectives. Margaret Hagan defines legal design as "the application of human-centred design to the world of law, to make legal systems and services more human-centred, usable, and satisfying" (Hagan, 2016).

According to Lulić and Saintot (2022), the lineage of this

approach traces back to "design thinking" popularized by the design and consulting firm IDEO in the late 1970s, and it has become an indispensable methodology for law to keep pace with the social fragmentation brought about by rapid technological innovation. While traditional legal education has historically treated the patience to decipher impenetrable texts independently as a badge of professional expertise (Lee-Remond, 2023), legal design presents a novel ethical and practical paradigm: the responsibility to mitigate cognitive load must shift from the receiver of information to its sender. In addressing this interdisciplinary intersection, Brunschwig (2021) offers a comprehensive framework that captures legal visualization as both a process and a product, articulating a new ethical mandate for designing responsible legal information within a digital society. Furthermore, contemporary frameworks in visual law have begun outlining comprehensive roadmaps for effective citizen participation (e.g., Parola & Poto, 2024).

Álvaro Antón (2023) champions the significance of this approach specifically within the domain of tax law, which is characterized by an exceptionally high degree of specialization and structural density. He argues that to transform tax law into a more citizen-oriented framework, implementing "legal design thinking"—which structurally reorganizes legal knowledge through a design lens—is vital. According to Antón, the role of an information designer extends far beyond cosmetic embellishments; it demands a profound empathetic comprehension of user needs and operational contexts to restructure the underlying legal content itself, thereby maximizing both clarity and understandability.

Even within Japan, embryonic attempts to visualize complex legal architectures do exist. For instance, a 2009 Cabinet Office publication utilized schematic diagrams to explain the structural interactions between the 16 primary tax acts, the STMA, and other peripheral statutes (see Figure 2-1). While these diagrams have played a certain role in providing a birds-eye view of the tax landscape, two profound limitations emerge when evaluated against the specific challenges this study aims to resolve:

First, these artifacts function strictly as administrative materials designed to explain governmental classifications, failing to unravel the internal logical linkages or the micro-structural syntax of

individual articles. Second, they remain trapped within the domain of information presentation, completely lacking an interactive architecture that supports users as they apply and evaluate the law relative to their unique scenarios. True information accessibility entails more than merely establishing a pathway to access data; it must signify a state wherein content can be intuitively understood and actively deployed in both practical and educational settings. In short, while existing administrative diagrams excel at displaying taxonomy, they completely lack the cognitive affordance necessary to guide a user on which specific provision to reference next. Because the assignment of meaning through typographic hierarchy, spatial layout, and color stratification remains fundamentally underdeveloped, the critical prioritization of information is never successfully communicated to the learner.

To genuinely enhance information accessibility, the strategic power of design—encompassing typography, color hierarchies, iconography, and spatial allocation—must be harnessed systematically. As articulated by Passera and Haapio (2013), visual elements should not serve as mere cosmetic supplements to text; instead, they must function as an active navigational infrastructure that dictates eye movement by emphasizing information weight and spatially defining structural relationships. This transformation liberates users from the exhausting cognitive burden of passively tracking continuous text and manually reconstructing legal logic within their working memory. In its place, it fosters an active dialogue wherein users can systematically explore visually structured information and efficiently extract the core logic of statutory conditions and legal effects necessary for jurisprudential interpretation.

In executing this transition toward the law as an interface, existing literature broadly delineates two distinct visual methodologies:

The first methodology is the human-centered design framework championed by Margaret Hagan (2016). The defining characteristic of Hagan's approach lies in translating jargon-heavy legal explanations into intuitive pictograms and logical flowcharts, thereby restructuring complex legal issues as spatial navigation challenges.

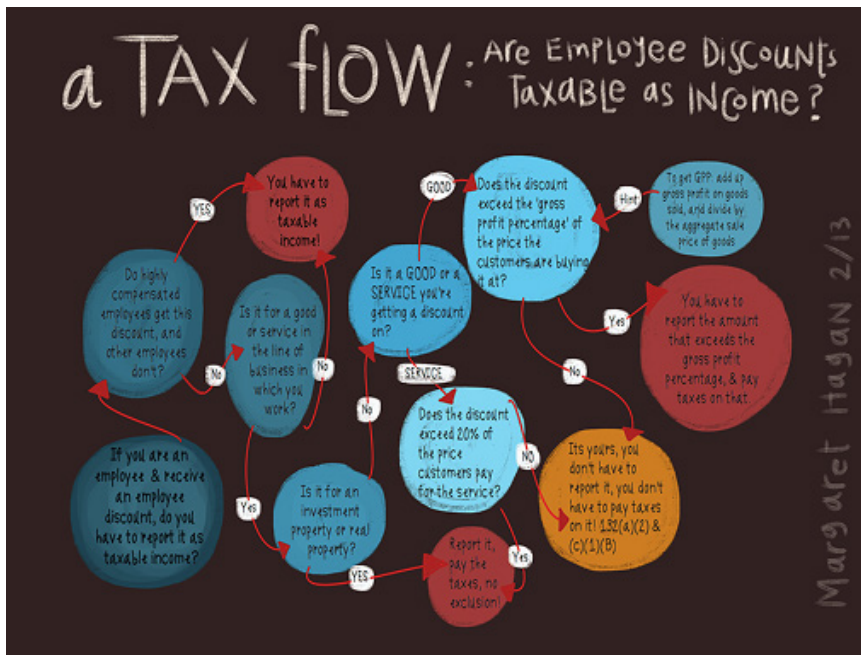


Figure 3-4. An example of the "Illustrated Law Flow Charts" project by Hagan, reconfiguring complex legal scenarios into a streamlined chain of binary (yes/no) inquiries to guide practical decision-making processes.



A quintessential manifestation of this methodology is Hagan's public Illustrated Law Flow Charts project (Figure 3-4). Within this project, highly intricate legal deliberations—including tax law scenarios—are structured as a streamlined chain of binary (yes/no) inquiries, allowing users to seamlessly retrace the path of legal reasoning based on their personal parameters. Rather than presenting professional statutory verbiage in its raw form, this method reconfigures the law into deliberate decision-making steps, intuitively rendering complex tax regulations as a navigable

information structure. Highlighting the pedagogical value of this approach, Hagan notes, "I wish every law class I learned was introduced with one simple overarching flowchart, that would show the essential tasks and questions that legal practitioners must proceed through when operating in this certain domain of law," thereby validating the immense importance of flowcharts in legal education.

The second methodology, exemplified by the "Lawmaps" framework developed by Scott McLachlan (2023) and his contemporaries, approaches visualization as a rigorous technical and operational infrastructure (Figure 3-5). McLachlan et al. introduced an information visualization methodology engineered to simultaneously capture both the implicit structure inherent within statutory text and the step-by-step procedural workflows executed by legal practitioners. McLachlan (2023) posits that the fundamental barrier to legal information accessibility resides in the complex, redundant, and dense nature of the law, which effectively bars individuals without specialized training from comprehending its overarching architecture. Lawmaps reduce this systemic complexity into graphical primitives (points, lines, and geometric shapes), utilizing spatial variables (position, shape, and color) to unearth underlying relational patterns, thereby aiming to democratize the law into a format accessible not only to legal

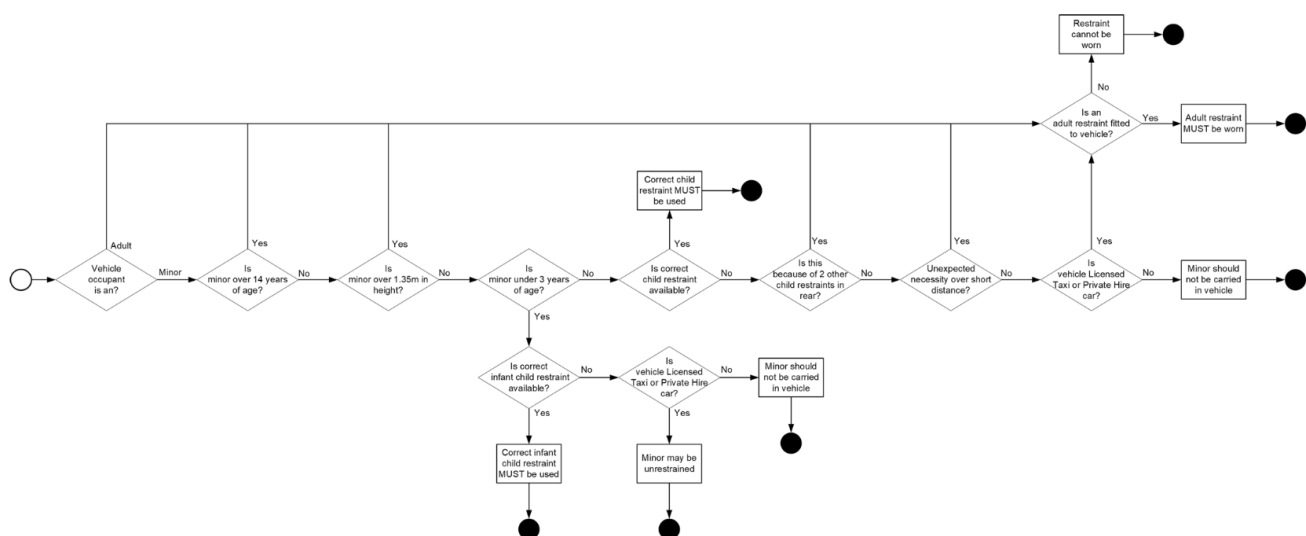


Figure 3-5. An example of the "Lawmaps" framework by McLachlan (2023), reducing systemic legal complexity into structured UML-based graphical primitives and spatial variables to visualize procedural workflows.

experts but to students and lay citizens alike. However, the visual language presented by McLachlan (2023) remains heavily reliant on standard Unified Modeling Language (UML) structures. Unlike Hagan's flowcharts, it stops short of optimizing visual design for end-users—particularly legal learners—failing to fully integrate crucial elements such as information prioritization and cognitive affordance.

In a comprehensive analysis, McLachlan and Webley (2021) categorized these existing visualization practices into eleven archetypal diagram types, revealing that conceptual flowcharts and UML diagrams remain the dominant paradigms. Crucially, however, they simultaneously highlight a profound "opportunity missed" within the discipline: despite the rich diversity of available visual methodologies, their practical adoption within legal practice and education remains heavily restricted.

The STMA—the core subject of this investigation—is characterized by a syntax wherein subjects and predicates are heavily congested with exhaustive modifiers and nested exceptional conditions, imposing an immense cognitive load on the reader. To navigate this friction, the logical rigor established by McLachlan et al. is absolutely indispensable. However, to foster autonomous and self-directed learning among intermediate legal learners, this rigor must be synthesized with the cognitive affordance and navigational empathy central to Hagan's philosophy.

Accordingly, this study proposes a consolidated visualization methodology that inherits the macro-level topological lens of domestic law visualization projects and the logical rigor of McLachlan's frameworks, while holistically integrating Hagan's paradigm of design as a navigational interface. Rather than merely compressing raw textual data, this framework systematically reconstructs the clauses of the STMA into a dynamic navigational flow composed of gatekeeping conditions and distinct legal outcomes, ultimately aiming to forge a seamless legal interface that bridges the gap between macro-systemic overview and micro-statutory interpretation.

3-3. Visualization as a Positive User Experience

Why is legal visualization—conceived not as a mere cosmetic supplement to text but as an autonomous framework—indispensable to legal education? The fundamental answer resides in its capacity to generate cognitive affordances that directly stimulate learner perception and provoke intellectual curiosity. Traditional diagrams within historical legal education were frequently restricted to oversimplified summaries of dense statutory provisions. Conversely, Dai (2025) concludes that integrating interdisciplinary approaches, including design thinking, into legal education is paramount for fostering students' problem-solving capacities, innovative thinking, and holistic comprehension

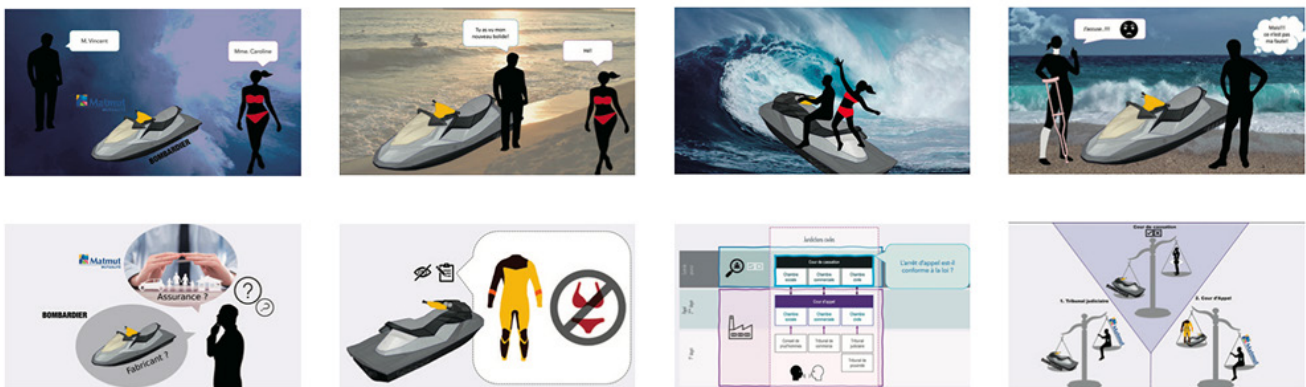


Figure 3-6. An example of the design-led legal education framework by Lee-Remond (2023), utilizing storyboards to spatially concretize abstract concepts and measure pedagogical efficacy.

of the law. The true significance of legal visualization lies not in the mere compression of data, but in its structural reorganization to provide learners with entirely new perspectives, serving as a potent mechanism to materialize this interdisciplinary paradigm.

In a study targeting non-law students majoring in business and technology, Lee-Remond (2023) empirically demonstrated the pedagogical efficacy of integrating a design-led approach into legal education (Figure 3-6). Employing storyboards to measure instructional outcomes, their research revealed that visualized educational materials substantially enhance students' problem-solving abilities and innovative reasoning. This suggests that by spatially concretizing abstract legal concepts, visual information empowers learners to perceive the law not as a detached

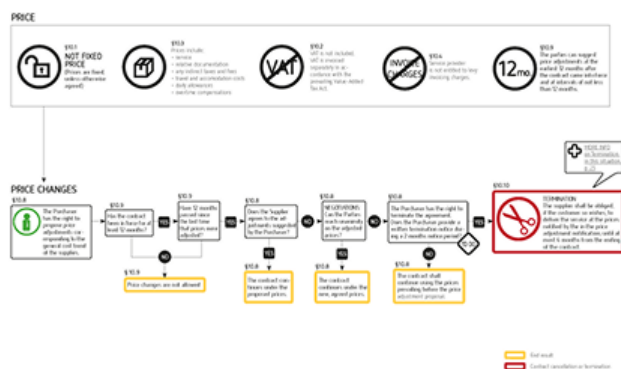
matrix of textual codes, but as actionable scenarios applicable to their personal experiences and daily lives. In essence, legal visualization possesses the transformative capacity to reconfigure legal study into an interactive, dynamic learning experience.

Nevertheless, asserting that legal visualization operates as an omnipotent panacea requires cautious scholastic scrutiny. Robinson (2009) sounds a cautionary note regarding the contemporary landscape, observing that graphic and pictorial formats have been promoted as promising solutions to the difficulties of understanding law, but again the results are less tangible, thereby highlighting that the empirical efficacy of visualization has historically lacked rigorous quantitative validation. Robinson emphasizes that law is a system of rules stipulating legal outcomes governed by conditions, thereby possessing an exceptionally stringent logical architecture. Consequently, translating instructional insights validated within scientific or mathematical disciplines directly into jurisprudential contexts demands rigorous caution to ensure absolute alignment with the internal logic of the law.

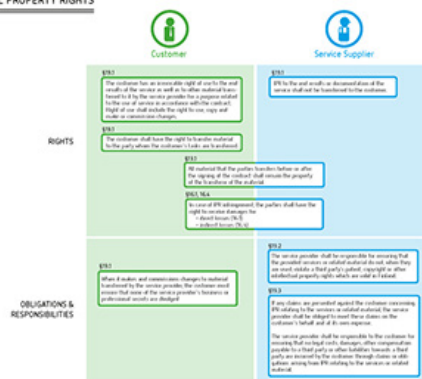
Yet, Robinson himself does not dismiss the necessity of visual interventions. Having led administrative teams tasked with providing statutory training to civil servants operating technical tax legislation, Robinson leveraged this practical experience to propose a system of training notes explicitly designed to diagram the law and clarify its logical architecture (see Figure 3-1). He powerfully argues that for law to function effectively within society, the representation of law in a comprehensible form is indispensable not only for legal experts but for the administrative practitioners tasked with its execution. Furthermore, contemporary information design research has actively sought to provide the empirical evidence regarding visualization outcomes that Robinson (2009) found lacking. For instance, Passera (2018) conducted a large-scale experiment targeting public servants, restructuring official administrative instructions into three distinct visual formats: flowcharts, swimlane diagrams, and timelines. The study empirically proved that the visual treatments significantly enhanced both task accuracy and processing speed (Figure 3-7). This represents a concrete empirical counter-argument, demonstrating that the waste of intellectual effort induced by



FLEXIBLE PRICE & PRICE CHANGES - The Customer suggests a price change



INTELLECTUAL PROPERTY RIGHTS



TERMINATION (The Purchaser does not accept the price adjustment suggested by the Supplier)

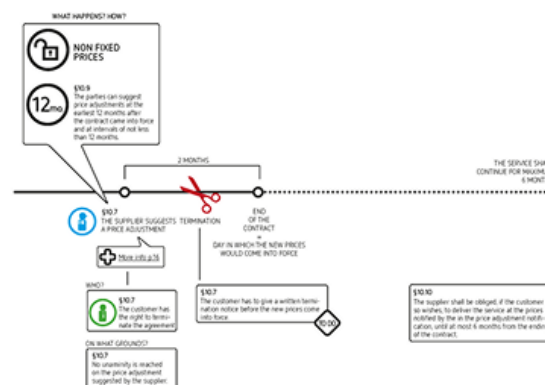


Figure 3-7. Visual formats evaluated by Passera (2018), including flowcharts, swimlane diagrams, and timelines, which empirically demonstrated that visual interventions significantly enhance both task accuracy and processing speed.

linear text—which Robinson criticized—can be successfully mitigated through optimized visual structures.

The primary obstacle encountered by most learners navigating tax law is the vastness of its scope, compounded by the extreme difficulty of discerning the boundaries between primary principles and multi-layered exceptional provisions. This systemic informational opacity creates profound psychological barriers for learners, ultimately depressing motivation and user engagement (Lee-Remond, 2023). To counteract this friction, Álvaro Antón (2023) highlights the vital movement toward simplifying legal information and rendering it accessible to the broader public through optimized communication design, while simultaneously acknowledging the value of behavioral approaches such as targeted taxpayer communications or television advertisements. Antón asserts that design can help in navigating text, opening its meaning and reinforcing its message, thereby advocating a profound paradigm shift from reading the law to seeing, listening,

and interacting with the law. He emphasizes that especially within educational environments and public-facing tax legal expositions, there is an urgent demand for design outputs rooted in legal design thinking, which synthetically merges psychology, jurisprudence, communication, design, and technology.

Indeed, the investigations by Lee-Remond (2023) confirmed that the cohort utilized storyboards co-created by legal scholars and designers exhibited significantly higher learning engagement

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1 Take a photo or video of your spot. You can use these in court.
 1. 拍摄您摆摊的位置的照片或视频。您可以在法庭上使用它们。
 1. Prenez una foto o video de su lugar. Usted puede utilizarlos en un tribunal.

2 Get names and badge numbers of the police.
 2. 获取警察的姓名和徽章号码。
 2. Conozca los nombres y números de insignia de la policía.

3 File a complaint if the police abuse your rights or are disrespectful.
 3. 如果警察滥用您的权利或不尊重您，请提出投诉。
 3. Haga una queja formal si la policía abuse sus derechos o le trata con una falta de respeto.

4 Show up in court if you don't, you'll be fined more.
 4. 如果您不出现，您将被处以更多罚款。
 4. Aparezca en el tribunal. Si no lo hace, será penalizado con multas mayores.

Police can't make you move, unless:
 警察只有在以下情况下才能让您移动：
 La policía no le puede mover, a menos que:

There is an emergency (Peligro)
 有紧急情况 (Un incendio)
 Hay una emergencia (Un incendio)

There is a big event (Paralelo)
 有大型活动 (Paralelo)
 Hay un acontecimiento grande (Un desfile)

KNOW THE LAW

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1. Get a license.
 1. 获得执照 (Licencia)
 1. Obtenga una licencia.

2. Vend on a legal street.
 2. 在合法的街道上摆摊。
 2. Venda en una calle legal.

3. Vend in a legal spot.
 3. 在合法的地点摆摊。
 3. Venda en un lugar legal.

KEY
 1 FT = 0.31 M
 1 M = 3.28 FT

Dimensions:
 >12 FT (3.7 M)
 >20 FT (6.1 M)
 >10 FT (3.1 M)
 <18 IN (0.4 M)

Figure 3-8. The "Vendor Power!" project by the Center for Urban Pedagogy (2009), demonstrating how visual design can deconstruct complex regulatory codes into intuitive illustrations to empower multilingual street vendors.

compared to the text-only control group. This outcome indicates that when the architecture of legal information is visualized through the power of design, it delivers an interactive and dynamic perceptual experience. Therefore, legal visualization transcends the status of a passive instructional aid; it functions as a critical educational intervention that empowers learners to autonomously discover the internal logic of statutory structures, thereby facilitating deep comprehension.

The positive user experience engendered by legal visualization extends far beyond academic legal learners. A premier historical precedent demonstrating how visual design can dismantle societal information asymmetries and contribute to civic empowerment is the work of the Center for Urban Pedagogy (CUP) in New York (Figure 3-8). For example, their 2009 project, *Vendor Power!*, targeted New York City street vendors who operated within a dense matrix of complex legal regulations while navigating severe multilingual barriers. Prior to the project's intervention, these vendors frequently faced sudden, exorbitant financial penalties due to regulatory violations of which they had no prior knowledge. In response, designers systematically deconstructed these complex penal codes into intuitive illustrations, pictograms, and simplified textual directives, successfully organizing the convoluted regulations into an accessible, folded poster pamphlet structured around clear dos and don'ts. This initiative underscores the profound capacity of visual design to build intuitive interfaces for comprehending intricate legal systems.

Furthermore, the core value of legal visualization lies in its ability to reconstruct the relational dynamics between the sender and receiver of legal information. For instance, a case study by the creative agency Candour, titled *Visual Legals* (Figure 3-9), demonstrated that introducing process flows and custom iconography into standard corporate terms and conditions transformed what was traditionally an onerous, impenetrable document into a powerful brand experience that embodied transparency and honesty. This case serves as empirical evidence that design can function as a potent tool to foster mutual understanding of legal information, thereby accelerating consensus-building in professional practice.

Moreover, the necessity of legal visualization has gained

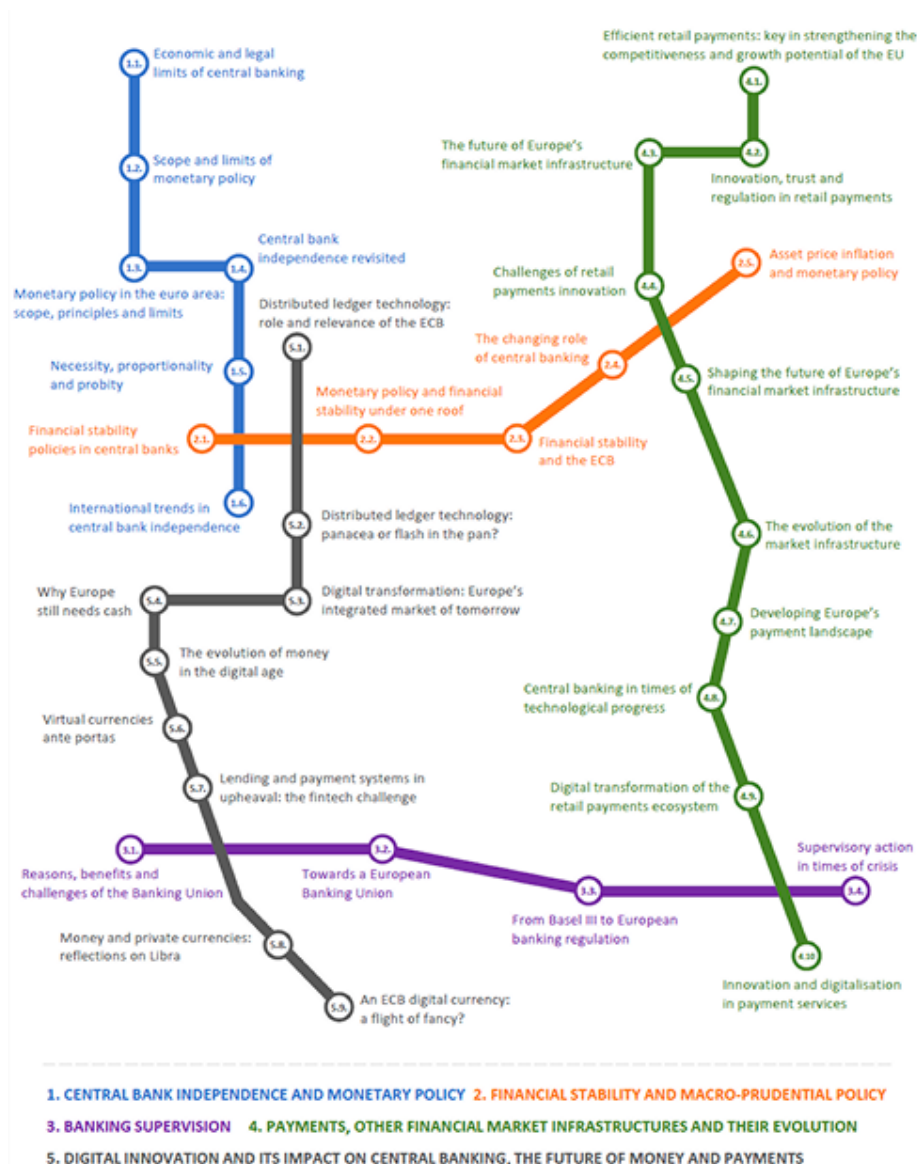


Figure 3-10. The ECB legal topical tube map presented by Lulić and Saintot (2022), leveraging the visual metaphor of a subway transit map to convert complex statutory hierarchies into a navigable, spatial environment.

3-4. Theoretical Synthesis and Research Positioning

Based on the extant literature reviewed above, it is evident that legal visualization encompasses a diverse array of methodologies, which can be broadly categorized into two primary paradigms. The first is the engineering-driven approach, represented by the legislation network framework (Koniaris et al., 2015) and the Japanese Law Visualization project (Shibao, 2017), both of which focus stringently on computing and visualizing the overarching structural topology of laws. The second is the design-driven approach, exemplified by illustrated law flowcharts (Hagan, 2016), the storytelling approach (Lee-Remond, 2023), and user-centric

visual guides (Passera, 2018). This latter approach primarily leverages visual expressions, such as simplified flowcharts and narrative storyboards, to render the substantive content of legal provisions comprehensible to users.

When contrasting the engineering-driven and design-driven paradigms, identical legal visualization formats—such as flowcharts—frequently emerge across both categories, yet they serve entirely distinct functions. For instance, while both Lawmaps (McLachlan, 2023) and Illustrated Law Flow Charts (Hagan, 2016) advocate the pedagogical efficacy of diagramming law during legal education, their visual executions diverge significantly: McLachlan’s system relies strictly on rigid, formalized engineering flowchart notations, whereas Hagan’s models incorporate intuitive illustrations and contextual narratives. This divergence does not imply a hierarchy of efficacy between the two paradigms; rather, it underscores that the engineering-driven and design-driven approaches operate under fundamentally different functional mandates and design objectives.

Consequently, when constructing an optimized legal visualization framework tailored for legal learners, researchers must simultaneously synthesize both dimensions: the mapping of complex macro-structural networks and the visualization of

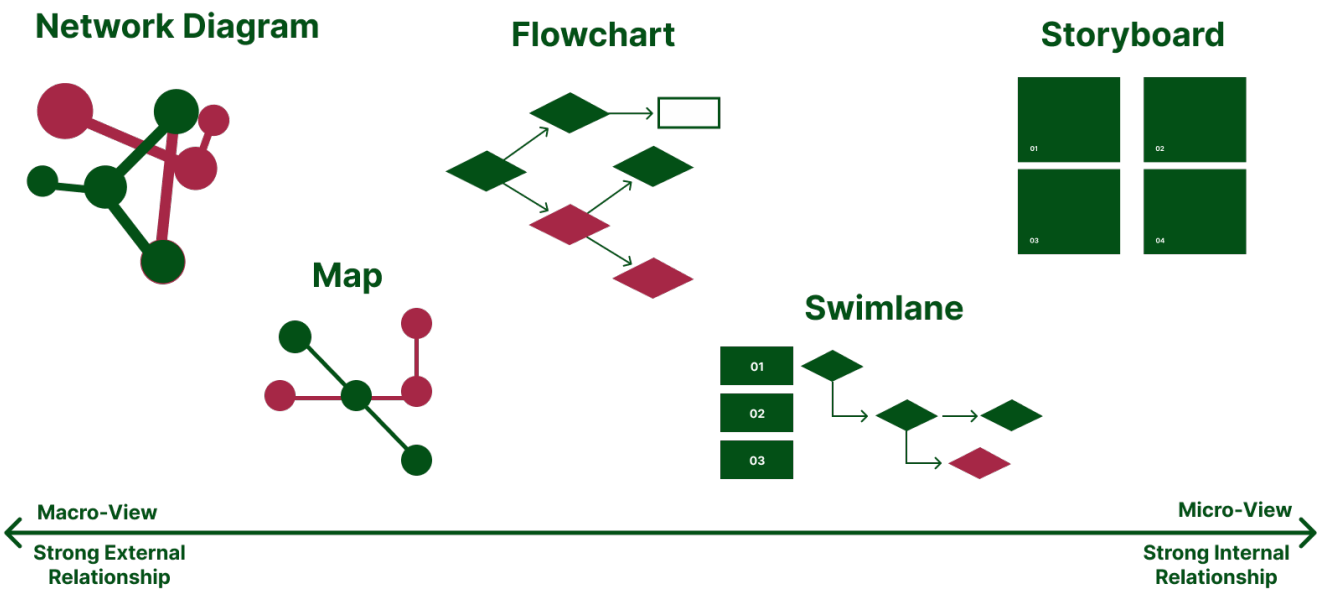


Figure 3-11. Mapping and classification of existing legal visualizations along the Macro-View and Micro-View axes. The diagram conceptualizes the structural continuum between the visualization of external statutory relationships (Macro-View) and internal operational rule content (Micro-View).

micro-level statutory content through intuitive visual design.

Figure 3-11 illustrates the classification of prominent legal visualizations identified in existing literature, mapped continuously along a structural continuum. In this study, legal visualizations focusing on external statutory relationships are categorized under the Macro-View, whereas those focusing on internal statutory dynamics are classified under the Micro-View. Specifically, visualizations that map interlocking chains of exceptional provisions or patchwork statutory architectures—typified by network diagrams—represent legal visualizations of external statutory dependencies. Conversely, those that diagram operational workflows and administrative application rules—typified by storyboards—delineate the substantive content of the law itself, thereby visualizing internal statutory relationships. Importantly, these two paradigms do not operate in isolation; rather, they form a reciprocal pedagogical synergy. The Macro-View (e.g., bubble diagrams) serves as a visual compass that allows learners to preemptively grasp the regulatory density, external systemic dependencies, and cognitive bottlenecks of a statute before engaging in textual analysis. This spatial awareness effectively reduces the learner's extrinsic cognitive load, thereby functioning as a crucial conceptual framework that prepares the mind to effectively apply the Micro-View tools (e.g., flowcharts and storyboards) to practical legal cases. Ultimately, legal visualization within the context of this study is defined not as a superficial summarization or compression of raw text, but as an intentional externalization of the dense legal reasoning process itself. It enhances the user experience not only for traditional jurisprudence students but for interdisciplinary learners outside the legal domain, practitioners pursuing advanced specialization in fields like tax law, and any legal learners requiring decisive statutory navigation to execute legal judgments. This research executes a deliberate design intervention engineered to empower these diverse legal learners to concretely decode the structural logic of the STMA through visual navigation, thereby guiding them toward actionable, practical comprehension.

Chapter 4.

**Methodology for Enhancing Legal
Literacy: Design for Tax Education**

Chapter 4.

Methodology for Enhancing Legal Literacy: Design for Tax Education

4-1. The Current State and Challenges of Taxpayer Education in Japan

To explore new angles and different methodologies aimed at making tax law issues more attractive and adapted to various kinds of target populations, Álvaro Antón (2023) launched an innovative legal visualization project. This multidisciplinary initiative engaged not only legal scholars but experts across communication theory, information technology, and visual design, operating under the core philosophy to see the law, do not just read it. The primary objective was to design an administrative mechanism capable of communicating highly complex information to European Union (EU) citizens—thereby facilitating both systemic comprehension and autonomous decision-making—which marked a profound paradigm shift in jurisprudential methodology. Conversely, Antón identified a critical institutional risk inherent in his project, noting that jurists are in principle reluctant to use these techniques, a statement that underscores the contemporary reality wherein communication design remains severely underutilized within the field of taxation.

Nevertheless, because the taxation system fundamentally impacts every individual constituting a society, developing a

proper comprehension of its underlying legal framework plays an indispensable role in a democratic state. The payment of taxes represents both a constitutional obligation for citizens and a fundamental right as active stakeholders who sustain public services. For citizens to correctly fulfill these duties and exercise their sovereign rights, the administrative authorities bear an ethical responsibility to provide legal information in a highly comprehensible format. Indeed, Antón (2023) highlights that implementing effective communication strategies remains a paramount challenge in reinforcing contemporary taxpayer service approaches.

Internationally, the vital importance of taxpayer education has gained widespread recognition. Since publishing its inaugural report on the subject in 2015, the Organisation for Economic Co-operation and Development (OECD) has continuously emphasized the significance of fostering a robust tax compliance culture and enhancing global citizenship.

Furthermore, in 2021, the OECD released its second edition report, which comprehensively reviewed diverse educational initiatives across 59 developed and developing nations, mapping the structural correlations between these programs. According to this report, contemporary taxpayer education encompasses systemic initiatives designed to build a culture of fiscal compliance through the following dimensions:

- Teaching taxpayers, providing in-depth tuition, building new knowledge and skills;

- Using communication tools to raise awareness in taxpayers of the different aspects of tax, including obligations, deadlines, taxpayer rights and how taxes are spent; and

- Providing taxpayers with practical assistance in tax compliance.

Moreover, the OECD (2021) asserts that education effectively empowers taxpayers and enhances tax morale. In particular, dismantling the systemic inequalities bred by knowledge asymmetry and embedding both the capacity to fulfill obligations and the continuous habit of compliance within the citizenry are positioned as pressing, critical imperatives in modern tax administration.

In stark contrast to these global evolutionary trends, tax education in Japan is heavily confined within the rigid institutional

framework of primary and secondary school education targeting minors (elementary, junior high, and high school students). At the national level, the Council for Promoting Tax Education—an inter-ministerial body comprising the National Tax Agency (NTA), the Ministry of Internal Affairs and Communications (MIC), and the Ministry of Education, Culture, Sports, Science and Technology (MEXT)—collaborates to devise supportive instructional policies. Within the domestic administrative landscape, tax education is officially categorized as a subset of taxpayer services, designed to construct an environment that fosters a basic understanding of the societal significance and fiscal roles of national taxation.

However, these domestic initiatives remain overwhelmingly concentrated on underage cohorts. Concrete manifestations of tax education within the school curriculum primarily include dispatching guest lecturers to tax classrooms (Sozei Kyoshitsu) upon institutional request, sponsoring student essay contests on taxation, and organizing seminars for educators. Crucially, none of these programs instruct students on the operational, concrete mechanics of statutory tax systems; instead, they stop short at demonstrating general tax utilization and its overarching societal necessity. This limitation is dictated by the National Curriculum Guidelines mandated by MEXT, which integrate tax education strictly as a component of "sovereign education" (Shukensha Kyoiku). These guidelines dictate that while the general role of taxation must be introduced across various age groups, the curriculum must not penetrate specialized legal or technical instruction.

Regarding adult taxpayer education, current administrative practices are limited to sporadic public lectures and informational briefings aimed at fostering compliance awareness. However, comparative metrics expose a profound structural imbalance: while the number of dispatched lecturers for school-level tax classrooms reached 44,895 in the 2024 fiscal year, the total number of public lectures hosted for adult citizens stood at a meager 1,217 sessions nationwide during the same period. These statistics vividly expose an acute deficit in actual educational opportunities tailored for adult taxpayers.

This systemic deficiency in taxpayer education triggers a cascading lack of fundamental tax literacy among young adult

demographics, leaving them reliant on fragmented media coverage, which often focuses on policy conflicts rather than structural tax mechanics. In an empirical survey of approximately 160 university students conducted by Sawada (2008), data revealed that only about 10% of respondents had ever received formal tax education during their elementary, junior high, or high school years. Consequently, the study highlighted that roughly 80% of university students possessed virtually zero functional knowledge regarding taxation.

Furthermore, even for autonomous citizens who proactively attempt to self-educate, the extreme difficulty of available instructional texts acts as an impenetrable barrier. Because tax law demands highly specialized jurisprudential training, there is an absolute shortage of "intermediate-level" educational resources capable of bridging the massive chasm between oversimplified public pamphlets and dense, academic treatises. While instructional materials engineered for professional qualification examinations can serve as effective educational tools, the sheer complexity of tax law naturally depresses the student population, thereby severely restricting the market volume of available commercial materials. For instance, on the Japanese National Bar Examination, where candidates must select one elective subject out of eight options, labor law was chosen by 29.1% of examinees, whereas tax law was selected by a mere 5.2% of candidates in the 2025 fiscal year. Similarly, given that the annual pass rate for the Certified Tax Accountant (Zeirishi) examination persistently fluctuates within a highly restrictive range of 16% to 20%, achieving a systematic, cohesive comprehension of the tax framework remains exceptionally daunting, even for individuals possessing an inherent motivation to learn.

Ultimately, merely publicizing tax compliance awareness within the rudimentary framework of underage school education is profoundly insufficient to sustain contemporary Japanese taxpayer literacy. Consequently, there is an urgent demand to execute a deliberate design intervention: transforming impenetrable statutory architectures into highly legible, user-centric interfaces that empower adult learners to autonomously navigate, explore, and master the underlying logic of the law.

4-2. The Gap Between the "Ideal Taxpayer" and Reality

In Japan, where institutional opportunities for taxpayer education are remarkably scarce, the level of fiscal awareness and subjective tax satisfaction among adult citizens remains inherently low. According to an empirical survey conducted by Sakai (2021), approximately 70% of taxpayers express a profound lack of satisfaction regarding the taxes they pay, and only about 60% are even aware of their exact tax liability or whether they possess a tax filing obligation at all (Figure 4-1). Furthermore, regarding the explicit reasons for this dissatisfaction, 38.2% of respondents stated that they perceived their tax burden as excessively high, followed by 26.6% who expressed frustration regarding the governmental allocation and utilization of tax revenues. These metrics illuminate a troubling democratic reality: a substantial cohort of citizens harbor deep-seated resentment toward their tax obligations while remaining fundamentally ignorant of their actual fiscal burdens.

Do you feel a sense of satisfaction regarding the taxes you pay? (n=3749, %)

Satisfied, Somewhat satisfied, Somewhat dissatisfied, Dissatisfied, Uncertain



Do you know how much income tax you paid last year? (%)

Aware, Vague Unaware

(Total, n=3749)



(20s, n=304)



Data Source: Tokyo Certified Public Tax Accountants' Association (2018), via Sakai, K. (2021).

Figure 4-1. Taxpayer awareness and satisfaction levels (Data Source: Tokyo Certified Public Tax Accountants' Association, 2018; adapted from Sakai, 2021).

This alienation is intensified by how citizens acquire fiscal information. Sakai (2021) notes that the primary channel through which dissatisfied citizens obtain information regarding the tax

system is mass media, such as television and newspapers (42.6%), followed by a cohort that receives no tax information whatsoever (16.2%). This reality demonstrates that for the vast majority of citizens, functional taxpayer education is delivered not by official administrative disclosures, but through secondary mass media channels.



Figure 4-2. A screenshot of NHK's domestic news headline database, illustrating the concentration of tax-related reporting on political and budgetary abstractions.

However, relying on mass media as the default mechanism for taxpayer education presents a severe structural flaw, as commercial news coverage rarely provides actionable legal knowledge. A systematic survey of domestic news headlines broadcasted by Japan's public broadcaster, NHK, between January and March 2026, reveals that tax-related reporting was strictly confined to political abstractions, such as the "government budget bill," "consumption tax reductions," and "child-rearing tax credits" (Figure 4-2). These broadcasts focused exclusively on political conflicts or populist appeals to alleviate national tax burdens. As Sawada (2008) observes, the formal study of tax law is inherently unglamorous, dense, and inaccessible to the

general public. Under conditions where even highly motivated self-directed learners face an absolute deficit of instructional resources, the disproportionate media dissemination of sensationalized policy debates over structural tax mechanics inevitably widens the chasm between public tax awareness and true systemic understanding.

Paradoxically, as Sakai (2021) critically highlights, the standard of tax literacy demanded from taxpayers by the Japanese judiciary is exceptionally rigorous. A quintessential manifestation of this institutional expectation is a notable appellate court judgment regarding the retroactive application of tax regulations (Fukuoka High Court, October 21, 2008). In this case, a taxpayer challenged the constitutionality of an amendment applied retroactively, arguing that such a legislative shift was entirely unforeseeable. However, the court dismissed the appeal and affirmed the constitutionality of the retroactive application, declaring that because national daily newspapers had extensively reported the contents of the Outline of Tax Reform, a sufficient degree of legislative predictability existed for ordinary citizens.

Critiquing this severe judicial stance, Sakai (2021) asserts that even when public dissemination is demonstrably insufficient, there is no legal guarantee that this deficit translates directly into a lack of foreseeability; instead, this precedent highlights the mismatch between the formal availability of tax policy and the public's substantive capability to comprehend it. The ruling assumes that mass media coverage automatically translates into legal foreseeability, shifting the cognitive burden entirely onto ordinary taxpayers. Furthermore, Sakai (2021) underscores that cases where courts accept statutory complexity or structural ambiguity as a "justifiable reason" for tax evasion or non-disclosure are extraordinarily rare. Within the Japanese legal framework, the inherent density of tax law is never accepted as a valid excuse for taxpayer ignorance or misinterpretation.

Consequently, a profound and dangerous chasm exists between the state's idealized construct of a "rational, highly informed taxpayer capable of sophisticated information retrieval" and the empirical reality of an "uneducated taxpayer exposed to fragmented, sensationalized media streams." Sakai (2021) argues that true taxpayer education must encompass two mutually

reinforcing dimensions: the acquisition of foundational civic understanding as members of society, and the procurement of tactical legal knowledge for taxpayer self-defense. In the contemporary Japanese educational landscape, both dimensions are critically absent. The consequences of this deficit directly jeopardize low-literacy taxpayers in the form of sudden back-tax penalties, audits, and adverse administrative dispositions. To bridge this divide, the metric for information accessibility must be elevated from a state of mere formal inspection capability (formal availability) to a standard of substantive comprehension (substantive understandability).

4-3. Specific Design Requirements and Methodology

To alleviate the current deficit in adult taxpayer education, merely expanding the provision of official administrative information is insufficient; rather, it is indispensable to cultivate intermediate professionals—such as legal experts, administrative officers, certified tax accountants, or business professionals with legal literacy—who possess the capability to demystify and effectively communicate tax law across society. Under the current landscape in Japan, however, this crucial intermediate cohort remains systematically underdeveloped due to the rigorous difficulty of professional examinations and a severe shortage of instructional resources.

To bridge this chasm, this study intentionally delineates legal learners as the primary target user group, extending beyond those strictly specializing in tax law. This target cohort encompasses a diverse spectrum of continuous learners: undergraduate students and graduates who received formal legal education, candidates from non-legal disciplines preparing for the National Bar Examination to enter the legal profession, and practitioners who require ongoing statutory training in public or private sectors. By mastering complex tax frameworks through visualized educational materials, these legal learners are expected to serve as vital bridge builders (communication mediators) who reconcile dense tax legislation with the public perception of general taxpayers in

the future.

This strategic positioning raises a pivotal design question: what specific pedagogical and visual interventions are required for legal learners—who already possess an intermediate understanding of legal concepts superior to that of the general public—to correctly interpret and apply the Special Taxation Measures Act (STMA), which represents the zenith of statutory complexity?

Regarding tax pedagogy, Sawada (2008) argues that even within formal university tax law curricula, introducing foundational knowledge concerning the societal significance and operational roles of taxation at the very beginning of the instructional sequence significantly accelerates subsequent statutory learning. Furthermore, through semi-structured interviews, Lee-Remond (2023) demonstrated that incorporating narrative elements and real-world case studies derived from practical experiences through a distinct human narrator serves as the most effective methodology to reinforce students' emotional engagement and learning motivation.

As established in Chapter 2, the barriers inherent within the STMA consist of three primary dimensions: structural complexity driven by patchwork syntax, informational imbalance arising from ambiguous statutory definitions, and an accessibility gap caused by a total lack of visual synthesis in published administrative evaluation data. From a pedagogical perspective, these barriers translate into two explicit challenges for the learner: the extreme cognitive difficulty of decoding interlocking statutory exceptions and a severe lack of contextual visualization regarding how these laws apply to concrete professional practices.

While legal visualization encompasses diverse paradigms, it can be broadly bifurcated into two strategies: the visualization of statutory topology utilizing network diagrams, and the visualization of substantive content utilizing flowcharts and storyboards. Therefore, this research aims to evaluate the effectiveness of the proposed legal visualization methods by comparing them with traditional text-based presentations, specifically focusing on how they assist learners in navigating the structural complexities of tax law within practical cases. To operationalize this objective, this study defines the following two visualization requirements as its core methodology:

1. Macro-View: Quantification and Visualization of Structural Complexity

Prior to deciphering an isolated article, learners must be provided with a global overview of its cross-referential network, illustrating precisely which core statute and which specific provision the target text modifies. Adapting the network graph theories established by Koniaris et al. (2015), this Macro-View strategy maps the complex inter-statutory relations between the STMA and peripheral tax laws, as well as the dense intra-statutory references within the STMA itself, thereby uncovering the precise geometric bottlenecks where logical density peaks.

2. Micro-View: Visualization of Practical Statutory Application Cases

The operational reality of how a law executes in practice remains completely invisible within raw statutory prose. By integrating the formalized flowcharting models advocated by McLachlan (2023) and the empathetic storytelling storyboards demonstrated by Lee-Remond (2023), this Micro-View strategy translates abstract textual requirements into concrete, sequential case scenarios, converting dense legalese into conceptualized visual narratives.

For the targeted cohort of intermediate legal learners, this dual-layered methodology seamlessly synthesizes the presentation of structural syntax (the global architecture of law) with the presentation of practical narratives (the step-by-step application workflow). This interdisciplinary synthesis represents the original methodology of this study, engineered to empower learners to deconstruct the complex matrix of the STMA and acquire autonomous, resilient tax literacy.

These design requirements directly dictate the prototype construction executed in Chapter 5:

- **Within the Macro-View Prototype:** The system focuses on tracking the highly specialized terminology and cross-referential linkages embedded from Paragraph 1 through Paragraph 14 of Article 41 of the STMA. This visual treatment explicitly resolves the challenges of structural complexity and informational imbalance, pinpointing the exact syntactic

nodes where learners experience cognitive overload during close textual readings.

- **Within the Micro-View Prototype:** The framework leverages authentic administrative case data extracted from the official Q&A repositories of the National Tax Agency (NTA) directly linked to Article 41 of the STMA. By visualizing the procedural workflows and contextual narratives of these real-world disputes, the prototype dismantles the public accessibility gap, bridges abstract clauses with tangible human actions, mitigates extrinsic cognitive load, and explicitly exposes the systemic pitfalls where learners are most prone to misinterpretation.

Ultimately, the methodology articulated in this chapter serves as the foundational design philosophy for the prototypes developed in Chapter 5, while simultaneously establishing the rigorous metric-driven framework required for the comparative comprehension evaluation executed in Chapter 6.

Chapter 5.

**The Proposal: Visualizing the
System and Logic of STMA**

Chapter 5.

The Proposal: Visualizing the System and Logic of STMA

The visualization methodology of this study initiated from an early prototype developed through an intuitive design approach. At that preliminary stage, however, there was no structured framework to systematically evaluate which visual elements were effective or where specific improvements were required.

To address this limitation, Section 5-1 establishes and systematizes the evaluation axes and design rules for the final visualization proposals. Subsequently, based on a critical analysis of the challenges identified in the initial prototyping phase, Sections 5-2 and 5-3 elucidate the background, design intentions, and pedagogical utilities of setting specific evaluation criteria and configurations for the bubble diagrams, flowcharts, and storyboards, respectively.

5-1. Methodology: From Legal Text to Visual Logic

This section delineates the methodology employed to transmute the complex text of the Special Taxation Measures Act (STMA) into a structured visual logic. The visualization framework proposed in this study operates on a two-tiered approach: a "Macro-View" that provides an overview of the legal ecosystem, and a "Micro-View" that clarifies individual procedural and logical processes. The Macro-View is first utilized to identify and visualize the structural bottlenecks and cognitive obstacles where learners

frequently stumble. Based on these macro-analytical insights, the Micro-View then provides detailed graphical interpretations of concrete cases and specific logical structures.

The Macro-View Methodology

The development of the Macro-View methodology follows a strict, four-step technical workflow designed to eliminate subjective bias and ensure absolute reproducibility:

1. Extraction of Target Vocabulary: Isolating technical terms and phrases whose definitions are bound by external influences or exert structural influence on subsequent clauses.

2. Data Mapping: Systematically linking the extracted vocabulary with their specific cross-referential relationships.

3. Quantification via Scoring Logic: Measuring the structural density of each term by calculating its comprehensive In-degree and Out-degree impact scores.

4. Visual Reconstruction (Bubble Diagrams): Reconstituting the aggregated dataset into a relational bubble diagram using Figma to geometrically reflect statutory importance, lexical impact, systemic interdependencies, and external regulatory attributes.

The Micro-View Methodology

To bridge abstract statutory density with real-world scenarios, the Micro-View methodology systematically translates legal cases into logical visualizations through the following four-step process:

1. Case Selection and Chronological Alignment: Selecting practical legal cases and arranging their underlying legal requirements along a strict chronological timeline.

2. Statutory Mapping: Identifying and selecting the specific provisions and administrative circulars governing the requirements and timeline of the selected case. Since official English translations for some of the utilized statutory texts and circulars were unavailable, the author provided original English translations for these materials.

3. Contextual Supplementation and Anchor Linkage: Complementing the layout with precise annotations for ambiguous legal vocabulary and directly anchoring authoritative statutory numbers to each practical step or scenario.

4. Visual Reconstruction (Flowcharts and Storyboards):

Generating final, human-centered visual design proposals—such as sequential flowcharts and narrative storyboards—to maximize student comprehension and emotional engagement.

Selection of the Research Target

To implement and test this visualization framework, Article 41 of the STMA was selected as the primary research target due to its exceptional structural complexity and high practical significance. Article 41 stipulates the "Special Credit for Loans Relating to Dwellings" (commonly referred to as the Housing Loan Tax Credit). Excluding supplementary provisions, the core text of Article 41 is a monumental statutory block containing approximately 17,000 words (Japanese equivalent). While this tax credit system is highly relevant to citizens—often being the first occasion for salaried employees to file a final tax return—its eligibility criteria are meticulously segmented based on housing types and acquisition methods, making its pedagogical difficulty extremely high. Although it remains an impenetrable domain for complete legal novices, this article was selected as the analytical subject because it allows legal learners with a foundational understanding of civil law to apply logical deduction, even if they have no prior experience in tax law.

(1) Macro-View: Quantification and Visualization of Structural Complexity

Focusing on Article 41 (Paragraphs 1 through 14), this study extracted the complex web of cross-references involving external statutes, cabinet orders, and internal provisions within the STMA. To guarantee the objectivity of the visualization, the following extraction rules and scoring logics were defined.

The scope of analysis for the Macro-View was strictly confined to Paragraphs 1 through 14 of Article 41. These boundaries were established because, in addition to the "Basic Requirements" in Paragraph 1, critical exceptional provisions (special rules) such as Paragraph 6 (Special Housing Loans) and Paragraph 10 (Certified

Dwellings Loans), along with their associated legal definitions, are concentrated within this specific interval. These paragraphs constitute the core of the tax credit system and represent the most appropriate sample for verifying the multi-layered reference structures characteristic of the STMA. Conversely, Paragraphs 15 and onward primarily handle secondary special cases and procedural details that presuppose the application of Paragraph 1. Therefore, to fulfill the primary objective of this research—clarifying the foundational architecture of the legal system—the scope was delineated up to Paragraph 14, where the core system and its major exceptions conclude. Furthermore, Article 41-2 and Section 7-2 (Articles 36-2 through 36-5) were utilized to verify the general versatility and scalability of the methodology described below.

Extraction of Target Vocabulary

Rather than focusing on the legal "effects" of the clauses, the extraction process focused strictly on lexical definitions and "referential relationships." The following criteria were established for vocabulary extraction:

- **Inclusion Criteria:** Technical terms and phrases whose definitions are bound by external influences or exert influence on subsequent clauses, such as "as prescribed in Paragraph X," "as specified by Cabinet Order," "as provided in the X Act," "the same shall apply hereinafter up to Paragraph Y," or "hereinafter referred to as 'A' in this Article."
- **Exclusion Criteria:** Common vocabulary lacking specific legal definitions, mere procedural citations (which do not accompany a definition of a term), shorthand expressions for listings (e.g., "other than those listed in the preceding items"), and deemed provisions (reading-across rules).

Next, the extracted terms were mapped to their respective referential relationships, consolidating the target vocabulary for visualization. The referential relationships were documented by separating two distinct perspectives: In-degree (Cited by) and Out-degree (Citing). During this refinement process, even if a term initially met the inclusion criteria, it was excluded based on the exclusion rules if a detailed examination revealed it was merely

a "procedural citation" or a "deemed provision" without any vocabulary definition. Furthermore, the following hierarchy and standards were applied when mapping the extracted vocabulary to their referential relationships:

1. The primary unit of extraction is defined by referential relationships that directly bind the definition of the target vocabulary, such as "as prescribed in Paragraph X," "as specified by Cabinet Order," or "as provided in the X Act."

2. Even within parentheses that define clauses in detail, if an independent proper noun accompanying an external statutory reference appears (e.g., "a home building trader prescribed in Article 2, Item 3 of the Real Estate Brokerage Act"), it is extracted as an independent vocabulary item and referential relationship.

3. If a vocabulary item functions merely as an exclusionary provision or a procedural supplementary explanation, it is not treated as an independent term. Instead, it is consolidated as an attribute constituting the reference score of its parent vocabulary (e.g., "as specified by Cabinet Order" within "a residential house (meaning a house used for residence as specified by Cabinet Order)" is mapped to "residential house" rather than "house").

4. For terms used to describe newly defined vocabulary within a clause, such as "hereinafter referred to as 'Y' in this Article," the reference destinations are considered "constituent elements" of that new defined term. In such cases, the referential relationship is consolidated into the defined term itself and is not linked to individual words within the explanatory text (e.g., the transfer of rights " (a transfer due to expropriation or exchange prescribed in Article 33-4, Paragraph 1, or any other transfer specified by Cabinet Order (hereinafter referred to as 'transfer due to expropriation or exchange' in the following paragraph))" maps "transfer due to expropriation or exchange" to "Article 33-4, Paragraph 1," "specified by Cabinet Order," and "the following paragraph").

The extracted and refined data was systematically aggregated into a Google Sheets database titled 'Dataset(Macro-View)'.

Scoring Logic (Impact Score)

By measuring the In-degree (Cited by) and Out-degree (Citing)

of each vocabulary item, an "Impact Score" was calculated by summing the following weighted points according to their legal attributes (Figure 5-1). This score serves as an objective index indicating the degree of structural importance a specific term holds within the legal ecosystem.

A simple, unweighted count of referential links is insufficient for evaluating the structural hierarchy of legal terminology, as the contextual implications of In-degree and Out-degree relationships vary significantly. For instance, a term referencing a single external statute (e.g., the Income Tax Act) demonstrates a high external regulatory dependency, whereas a term referencing 30 internal provisions within the STMA exhibits a high internal systemic dependency. Treating these distinct relationships merely as raw values of "1" and "30" fails to capture the qualitative complexity of the legal ecosystem.

To overcome this limitation, the "Impact Score" was engineered to apply weighted coefficients based on the specific attributes of each regulatory source. This metric prioritizes the aggregate information foraging cost—specifically, the frequency of mental or physical context switching forced upon users during statutory interpretation. Within this framework, a higher score directly indicates that a term holds a more critical, foundational significance within the architecture of the STMA.

The scoring logic allocates weights based on four distinct levels of cognitive loads:

- **External Statutes (4 points):** Crossing statutory boundaries to unrelated codes imposes the highest cognitive friction.

External Laws (e.g, Income Tax Act)	4.0
Cabinet Orders (Detailed enforcement rules)	3.0
Other Articles within the STMA	2.0
Internal References (Other paragraphs/items within Art. 41)	1.0

Calculation Example:

If the term "New Construction of Residential Housing" references 2 internal paragraphs and 2 external articles within the STMA



Internal: 2 refs × 1.0 = 2.0 pts
External Articles: 2 refs × 2.0 = 4.0 pts

Total Score: 6.0 pts

Figure 5-1. Scoring logic weights by legal attribute and a calculation example.

Although separate columns in the dataset distinguish between inward influences (In-degree) and outward references (Out-degree), both dynamics generate an equivalently high cognitive load, as they equally compel the reader to shuttle between disparate legal frameworks and retain that information within the working memory.

- **Cabinet Orders (3 points):** Shifting focus to regulations at different administrative levels represents a severe context switch, demanding that readers search for external administrative definitions and incurring a substantial information foraging cost.
- **Cross-References within the STMA (2 points):** These links remain within the same legislative philosophy but require turning pages across separate articles, resulting in a moderate information foraging cost.
- **Intra-Article References (1 point):** Because visual transitions are limited to the immediate preceding or following context of the same provision, this layout minimizes contextual disruption and is easily processed within the capacity of the working memory.

Dataset

Based on the target vocabulary, cross-referential linkages, and calculated scores, a bilingual dataset was constructed in both Japanese and English using Google Sheets. The resulting dataset encompasses the following components:

	A	B	C	D	E	F	G	H	I	J	K	L
1	Provision /	Legal Term (Target)	In-degree	Out-degree	External Law	Cabinet Order	STMA Cross-Ref.	Intra-article	Impact Score	Font Size	Aggregate	Node Size
2	41.1-41.14											
3	41.1	居住用家屋の新築等		41.1/41.3/41-2.3.4/41-2-2			2	2	6	15		
4	41.1	居住用家屋	Cabinet Order	41.1~41.31		1		31	34	64		
5	41.1	居住用家屋で建築後使用されたことのないものの取得	Cabinet Order	41.1/41.10/41.20/41.21/41.27/41.35		1		6	9	19		
6	41.1	買取再販住宅の取得	Cabinet Order	41.1/41.3/41-2.3.4/41-2-2		1	2	2	9	19		
7	41.1	耐震基準	Cabinet Order	41.35		1		1	4	13		
8	41.1	既存住宅		41.1~41.31/41.35				32	32	60		
9	41.1	宅地建物取引業者	Real Estate Brokerage Act		1				4	13		
10	41.1	特定増改築等をした家屋	Cabinet Order			1			3	12		

Figure 5-2. Structure and column configuration of the extracted vocabulary dataset.

Column Descriptions (Figure 5-2)

- Provision / Art. No. (条文番号)

Indicates each article, paragraph, or item number within the STMA.

- Legal Term (Target) (対象語彙・条項)

The specific terminology extracted for analysis, maintained in the original Japanese. Terms defined with abbreviations, such as "hereinafter referred to as 'A'" (以下「A」という), are highlighted in red text.

- In-degree (Cited by) (被参照)

Indicates the frequency and source of references to this term from other provisions or laws. For clarity, ambiguous references such as "the preceding paragraph" (前項) or descriptive references like "the residence prescribed in Paragraph 6" (第六項に規定する居住者) are standardized using the specific provision ID (e.g., "41.6") to ensure precise mapping. If a term and its reference appear multiple times within the same provision, the term is counted only once. All corresponding reference numbers are recorded together, separated by a forward slash (e.g., 41.7/41.7).

- Out-degree (Citing) (参照先)

The original text of legal references cited by the target term. Each cell contains the Japanese text extracted from the statutes. Similar to In-degree, ambiguous references are clarified with specific article/paragraph names (e.g., "41-6").

- External Law Ref. (外部法律参照)

The count of references to statutes outside the STMA (e.g., Income Tax Act) identified in the In-degree and Out-degree columns.

- Cabinet Order Del. (政令委任参照)

The count of references Cabinet Orders and Finance Ministry Ordinances, typically identified by the phrases '政令で定めるもの' or '財務省令で定めるもの'.

- STMA Cross-Ref. (条外参照 (租特内))

The count of references to other articles within the STMA.

- Intra-article Ref. (条内参照 (同条内))

The count of internal references within Article 41 itself, such as "this paragraph," "paragraph 3," or "this item."

- Impact Score (効果影響スコア)

A unique weighted score used to determine the

node size (circle diameter) in the bubble diagrams. Calculated as: (External Law Ref. $\times 4$) + (Cabinet Order Del. $\times 3$) + (STMA Cross-Ref. $\times 2$) + (Intra-article Ref. $\times 1$).

- **Font Size (Visual)** (各単語のフォントサイズ)

The visual setting for the keyword's font size during mapping. Based on the Impact Score: a score of 1 corresponds to a font size of 10, with the font size increasing by 1 point for every 1-point increase in the Impact Score.

- **Aggregated Impact Score per Article** (条項内の合計効果影響スコア)

The sum of all Impact Scores within a specific article or provision.

- **Node Size (Article Radius)** (条項の円の大きさ)

The visual setting for the provision's circle size during mapping. Calculated as: (Aggregated Impact Score per Article $\times 2$) + 150.

Graphical Rules for Visualization

Based on the aggregated data, the spatial and logical relationships between statutory clauses are visually translated into a bubble diagram within Figma, adhering to the following design rules (Figure 5-3):

- **Circle Size (Statutory Importance):** Each paragraph is represented by a gray circle, with its diameter directly proportional to the total impact score of the vocabulary contained within that specific paragraph. Paragraphs that contain no extracted vocabulary are omitted from circle rendering, with only their respective paragraph identifiers displayed in italics. Note that while these provisions are cited using standard statutory notation in the body text (e.g., Article 41(1)), they are designated using a simplified numerical format within the diagrams and datasets for visual clarity (e.g., 41.1 represents Article 41, Paragraph 1).
- **Typography (Lexical Impact):** The font size of each term is scaled according to its individual score. Terms that define abbreviations or aliases are highlighted in red text, while all other terms are displayed in black.
- **Overlapping Circles (Interdependency):** Paragraphs that share direct referential relationships are placed with overlapping circles. Paragraphs with high systemic affinity

are placed in close spatial proximity, even if they do not overlap. If a paragraph contains specific sub-items (Items), smaller internal circles corresponding to the number of items are nested within the main paragraph circle.

- **Geometric Shapes and Colors (External Source Attributes):**
The attributes of external regulatory sources influencing each paragraph are mapped inside the gray circles using color-coded geometric shapes: Blue (External Statutes), Red (Cabinet Orders), and Yellow (Other STMA Articles).

Figure 5-3. Application example of visual design rules for the macro-view bubble diagram.



(2) Micro-View: Visualization of Legal Application Cases

To connect abstract statutory text with concrete scenarios, two question-and-answer cases that frequently cause misconceptions among learners were selected from the National Tax Agency's official guidelines. Using Figma and Adobe Illustrator, these cases were converted into a flowchart and a storyboard.

Case Study 1: Flowchart

Theme: The eligibility for the re-application of the Housing Loan Tax Credit when only the taxpayer's family returns to resume residency.

The design aligns condition branches along a strict temporal axis—from the initial "occurrence of the circumstance" (relocation order), through "re-residency by family," to the "future intent to cohabitate"—clarifying the exact procedural path of legal application.

Case Study 2: Storyboard

Theme: The eligibility for the re-application of the Housing Loan Tax Credit when an employee participates in the Japan Overseas Cooperation Volunteers (JOCV) while maintaining employment.

The storyboard utilizes a narrative format spanning six sequential panels to visualize how abstract legal requirements, such as "a relocation order from the payer of salaries or other unavoidable circumstances equivalent to this," intersect with real-world employment factors (e.g., leave-of-absence systems and salary structures).

Through this bidirectional approach combining Macro-View and Micro-View methodologies, a design proposal was established to simultaneously resolve structural complexities inherent in statutory design and cognitive barriers in user comprehension.

5-2. System Visualization: Relational Bubble Diagrams (Macro-View)

5-2-1. Initial Exploration

In developing the Macro-View methodology, the initial phase focused on Paragraph 1 of Article 41 (41(1)), which forms the bedrock of the entire housing credit system. By intuitively visualizing its logical framework, preliminary boundaries for vocabulary extraction were explored.

Linguistic and Structural Characteristics of Article 41, Paragraph 1

Paragraph 1 stipulates the fundamental requirements for the housing loan credit, yet it consists of an incredibly long block of text—approximately 1,222 words (Japanese equivalent)—written with almost no punctuation breaks. This dense structure presents a major barrier when learners attempt to isolate individual credit criteria.

Furthermore, the unique grammatical structure of the Japanese language aggravates cognitive load. While English (an SVO language) allows readers to immediately grasp the causal relationship between subject and predicate, Japanese (an SOV language) suspends the legal effect (the conclusion) until the very end of the sentence. This grammatical trait demands immense working memory during reading. Because this linguistic structure impacts the entire text, learners struggle to discern whether parallel conditions represent "cumulative necessary conditions" or "exclusionary conditions."

Visual Explorations through Initial Prototypes

The initial prototype (Figure 5-4) attempted to diagram the clauses, phrases, and logical relationships of 41(1) using color-coded boundaries based on the following rules:

- **Red Text / White Knockout:** Defined terms and abbreviations that affect subsequent clauses.
- **Color-Coded Attributes:** Cabinet Order designations (Green), Exclusionary provisions (Yellow), Limiting clauses (Purple),

and Item-related terms (Pink).

- Light Blue Text: Explicit cross-references indicating statutory numbers.
- Green Arrows: Definitions cited from external statutes (e.g., Real Estate Brokerage Act, Income Tax Act).

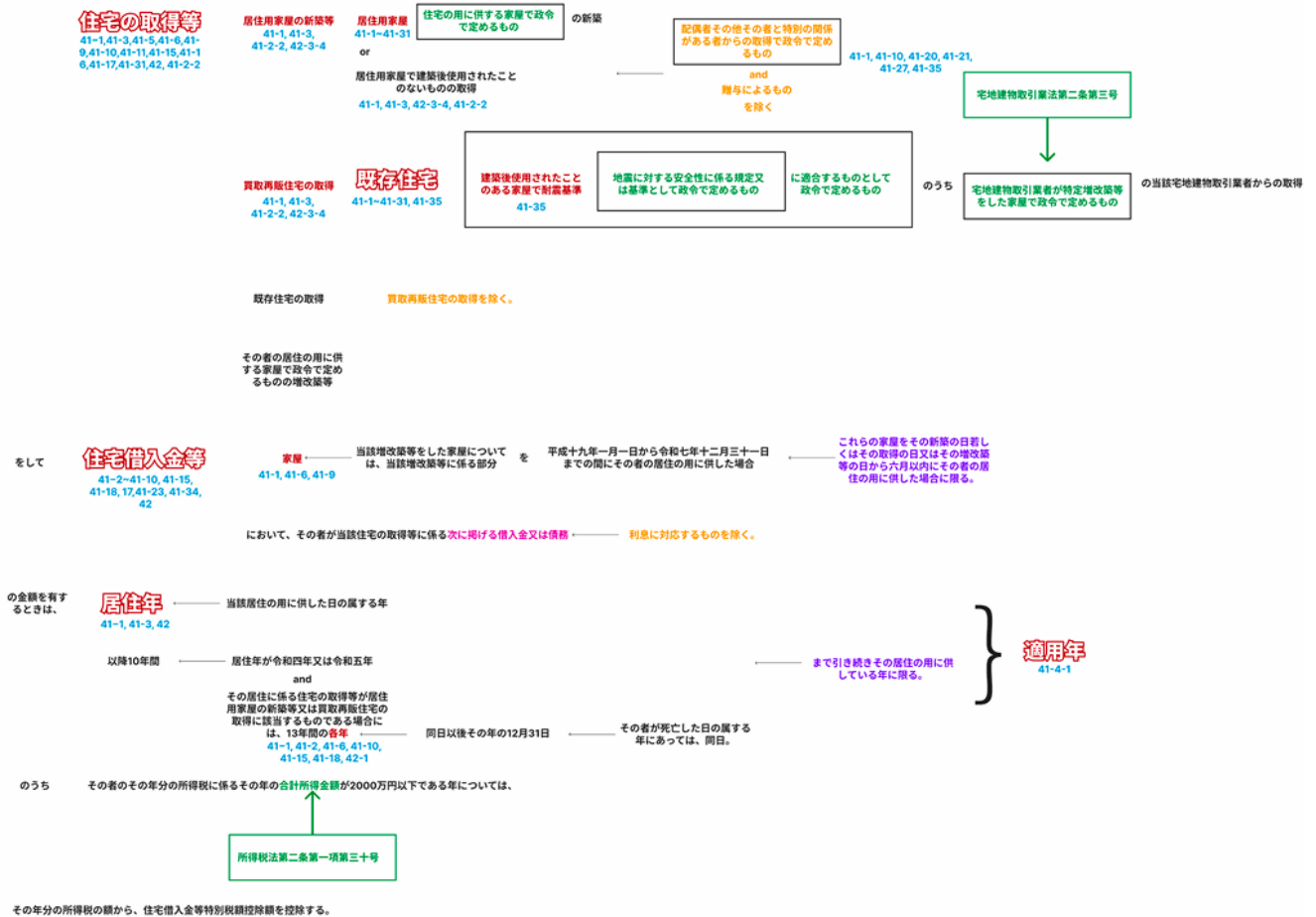


Figure 5-4. Early manual prototype of text-based color-coding and logical diagramming.

Limitations and Challenges Identified in the Initial Phase

This exploration revealed that a one-dimensional color-coding system cannot adequately represent the multi-layered attributes inherent in law. For instance, the phrase "excluding acquisitions through gift or from spouses or other relatives with a special relationship to the individual, as specified by Cabinet Order" simultaneously contains two overlapping elements: a "Cabinet Order designation" and an "Exclusionary provision" regarding special relationships. A single-color spectrum fails to convey these overlapping attributes accurately. Introducing

nested geometric frames to resolve this issue heightened visual complexity, ultimately creating a counter-intuitive layout that undermined accessibility.

Moreover, the nested, hierarchical architecture of tax law made defining consistent manual extraction criteria difficult.

Case Analysis: Definition of "Existing Dwelling" (41(1))

"...a house that has been used for residence after its construction and matches the earthquake resistance standards (meaning provisions or standards regarding safety against earthquakes specified by Cabinet Order; the same shall apply in Paragraph 35) as specified by Cabinet Order (hereinafter referred to as an 'Existing Dwelling' up to Paragraph 31 and in Paragraph 35)..."

In this context, a two-tiered legal judgment is embedded: (1) the Cabinet Order designation of the earthquake standard itself, and (2) the Cabinet Order designation of a house's compliance with that standard. While a thorough analysis should extract both "earthquake standards" and "compliance with earthquake standards" as separate nodes, the text logically subsumes compliance within the definition of "Existing Dwelling." Extracting them independently caused a double-counting of information, needlessly complicating the diagram.

Additionally, accurately translating Japanese logical connectors into visuals (such as distinguishing between the primary "And" [及 び] used for macro-groupings and the secondary "And" [か つ] used for internal sub-conditions) presented a paradox: pursuing absolute legal precision directly compromised visual accessibility.

Summary: Transition to a Quantitative Approach

This series of iterations demonstrated that intuitive diagramming lacks an objective mechanism for prioritizing information. Furthermore, to avoid the double-counting of nodes, vocabulary extraction must be conducted manually while carefully considering the underlying logical hierarchy.

5-2-2. Critical Reflection

The critical analysis of the initial prototype (5-2-1) revealed a fundamental challenge that went beyond mere visual clutter: the lack of a clear hierarchy of information importance. Based on these insights, the essential design criteria required for a visualization framework capable of exposing structural bottlenecks for legal learners were defined as follows:

1. Information Hierarchy

When all clauses and technical terms are color-coded and arranged with equal visual weight, the distinction between the system's core structure and its secondary details is entirely lost. Learners do not require an exhaustive mapping of every word; rather, they seek an intuitive grasp of the structural backbone and pivotal terms. Intuitive diagramming fails to provide a quantitative benchmark for designing visual hierarchies that reflect multi-layered logic, which flattens information priority. Consequently, this study decided to scope the visualized data strictly to the interplay between technical vocabulary and statutory cross-references.

2. Simplified Rules

The accumulation of color-coding and boundary framing forced users to learn an entirely new set of "decoding rules" just to understand the diagram, defeating the purpose of the visualization. This merely replaced what Robinson (2009) termed "intellectual labor wasted on linear text reading" with an alternative form of visual noise. Therefore, the design strategy shifted toward establishing minimal, highly simplified rules that enable learners to intuitively recognize core paragraphs and legal relationships.

3. Objective Metrics

Legal terminology is inherently lengthy. Relying solely on static arrows or colors to indicate referential links cannot untangle the patchwork structure of the STMA into a readable format. To foster autonomous understanding, the visualization must eliminate the designer's subjective bias and map the actual "structural density

and sparsity" based on objective data.

4. Selection and Verification of Visualization Layouts

To represent the structural complexity of the STMA, various visualization methodologies were systematically evaluated:

Application of Accounting Flowcharts (Figure 5-5): Inspired by cost accounting flowcharts used in bookkeeping to trace cost allocations visually, a box-and-link model for vocabulary was evaluated. While highly intuitive for learners familiar with financial accounting, linking thousands of definitions and rules via interconnected boxes caused exponential growth in visual complexity, mimicking the failures of the initial prototype. It was deemed unsuitable for this study.

Network Diagrams (Figure 5-6): Network models, such as those demonstrated in the literature by Koniaris et al. (2015), excel at



Figure 5-5. Exploratory box-and-link layout inspired by accounting flowcharts.

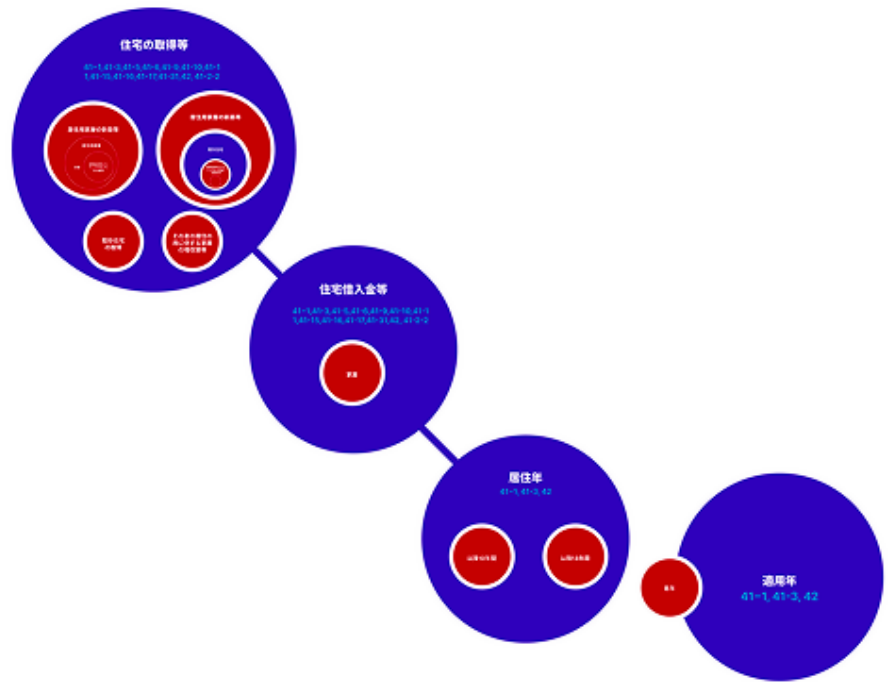


Figure 5-6. Prototype of a flat network model showing obscured structural dependencies.

charting cross-references across statutory bodies. Following this approach, a network diagram was modeled using terms defining abbreviations (Alias Definitions, e.g., "hereinafter referred to as 'A'") and parenthetical definitions (Descriptive Definitions) as nodes, connecting them via links representing clauses punctuated by periods. However, when mapping the STMA's unique internal self-references onto a flat plane, drawing the multi-layered structures required nesting nodes inside other nodes. This dissolved the core functionality of a network graph and obscured the meaning of the links.

Attempting to visualize relationships focusing strictly on mutually influential terms caused severe visual degradation, making it unviable for maintaining legibility. However, the network prototype demonstrated that representing legal vocabulary benefits greatly from nested configurations (circles enclosing smaller circles). Based on this finding, it was concluded that the bubble diagram format was the optimal visualization layout.

These reflections confirmed the necessity of transitioning from a simple visual conversion of text to a structured visualization grounded in strict extraction rules and an objective scoring logic.

5-2-3. Final Refined Visualization

This section details the design intentions and pedagogical advantages of the final bubble diagrams proposal, which integrates the scoring logic and graphical rules defined in Section 5-1. These insights serve as foundational design criteria for the Micro-View prototypes detailed in Section 5-3 (Figure 5-7).

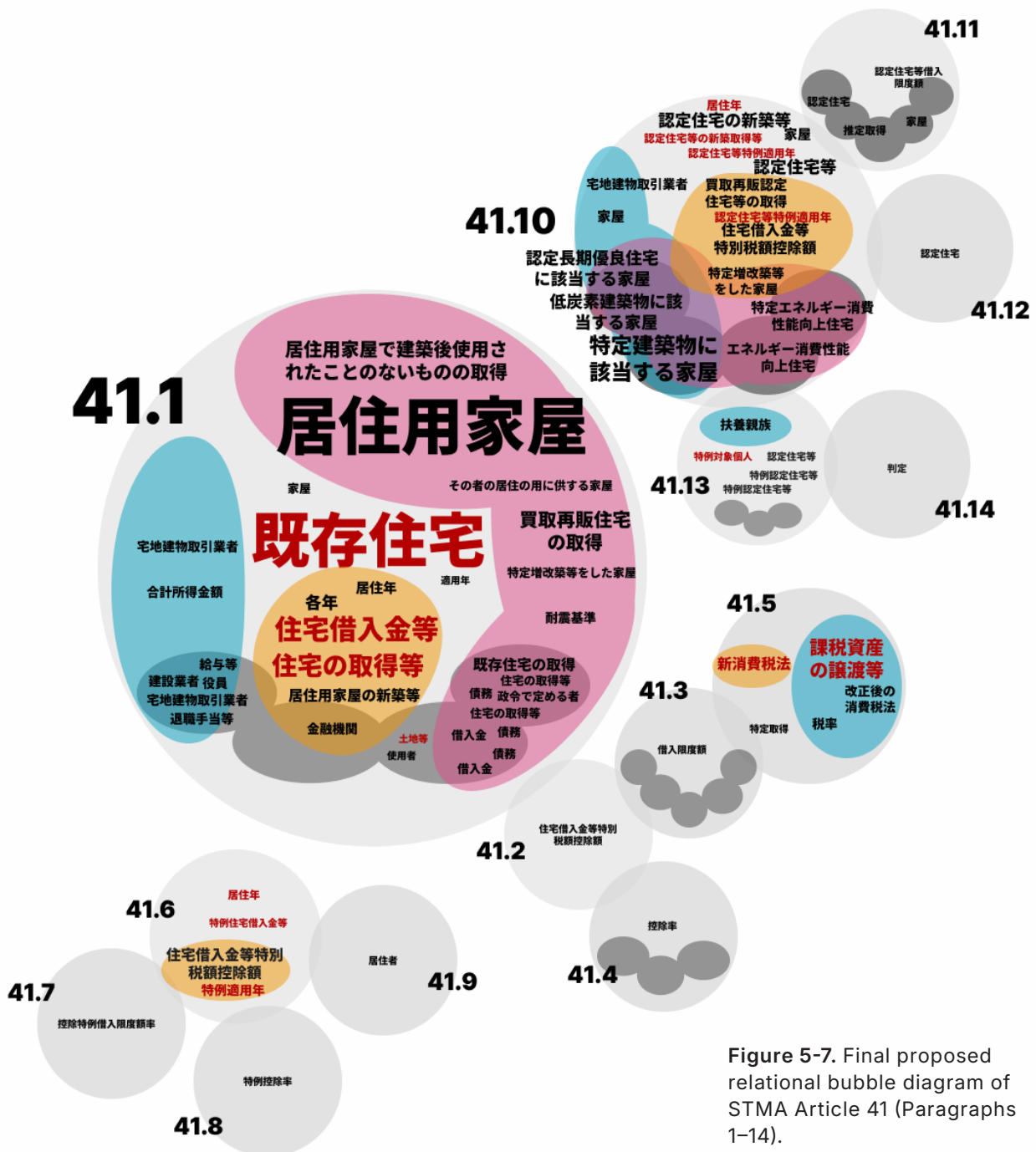


Figure 5-7. Final proposed relational bubble diagram of STMA Article 41 (Paragraphs 1-14).

1. Mapping Statutory Clusters

The structural architecture of the STMA follows a pattern where core provisions are immediately trailed by numerous paragraphs dictating definitions and exceptions. In this diagram, each paragraph is represented by a dedicated circle. Directly intersecting clauses are rendered with overlapping boundaries, while clauses with high systemic affinity are placed in close spatial proximity without overlapping, effectively mapping their legal relationships. Specifically, paragraphs with direct cross-references or supplementary roles (e.g., 41(1) and 41(2), which elaborates on the credit calculation) are designed with overlapping circles. Conversely, exceptional paragraphs that extend the scope of 41(1) (such as Paragraph 10 for certified dwellings) are clustered near 41(1), visually signaling that while they are legally independent, they remain systemically intertwined. This spatial layout allows learners to survey the legal landscape like a map, recognizing the positions of core and peripheral information prior to conducting a deep text reading.

Furthermore, while paragraphs exist beyond the examined range of 41(14), they contain no vocabulary meeting the extraction criteria. Rendering these as fully filled circles would obscure the distinction between data-rich and data-null clauses. Therefore, these empty paragraphs are represented solely by modifying the typography of their numbers into italics, allowing learners to verify the total volume of the statute without encountering visual noise.

2. Identifying High-Impact Terminology

The pivotal terms governing the logic of the entire legal framework are scaled dynamically based on the "Impact Scores" derived from the 5-1 scoring logic. Furthermore, the diameter of each paragraph circle is proportional to the aggregate scores of its internal vocabulary. This allows learners to intuitively gauge importance at both the lexical and statutory levels. By establishing these visually prominent Anchor Points, learners navigating subsequent complex clauses can instantly trace a term back to its original definition. This visual hierarchy drastically reduces the cognitive friction caused by frequent cross-referencing during statutory reading.

3. Visualizing Regulatory Interdependencies

As the STMA has grown increasingly complex, its definitions have become heavily reliant on external factors such as cabinet orders and separate statutes. The final diagram exposes this multi-layered influence structurally by mapping color-coded geometric shapes inside the gray paragraph circles: Blue (External Statutes), Red (Cabinet Orders), and Yellow (Other STMA Articles). This structural trait is highly visible in Paragraph 10 (41(10)), where specific terms clearly depend on both cabinet orders (Red) and external statutes (Blue), or cabinet orders (Red) and alternative STMA provisions (Yellow). By exposing these external linkages that remain fragmented in linear text, the visualization prevents learners from getting lost in individual clauses, enabling them to grasp the regulatory ecosystem as an integrated whole.

5-3. Visualizing the Logic: Case-Based Design (Micro-View)

5-3-1. Logic Extraction from Cases

Prior to generating the Micro-View visualizations, a systematic process was executed to extract necessary visual elements from the target cases and reconstruct their legal logic. The primary source material consisted of question-and-answer cases published on the National Tax Agency's website. Rather than merely transcribing this information, practical legal insights were applied to curate, select, and supplement the data to optimize intuitive user comprehension.

Flowchart Extraction

For Case Study 1 (the re-application of the credit when only the family returns), the legal criteria required for re-application were thoroughly audited and distilled into six core components. During information selection, the framework went beyond the direct statutory criteria for re-application to explicitly incorporate chronological prerequisites that are frequently overlooked, such

as verifying that "the initial credit application was successfully filed." This design intervention proactively blocks interpretive errors common among learners who lack an overview of the system's timeline.

Storyboard Extraction

For Case Study 2 (JOCV participation while maintaining employment), the abstract legal requirements were translated into concrete contextual elements suitable for narrative representation. In designing the narrative, the listing of isolated legal criteria—such as the granular metrics of the leave-of-absence requirement—was avoided. Instead, extraction focused on pivotal "life events": purchasing the home, evaluating volunteer participation, and the actual deployment period. Mapping these elements chronologically revealed a five-year timeline required to reach the legal conclusion. This long-term temporal progression was adopted as the core structural spine of the storyboard.

To anchor this narrative legally, the scenario directly linked Article 41, Paragraphs 1 and 28 with STMA Administrative Circular 41-4, which governs the operational details of Paragraph 28. This seamless connection allowed the design to preserve both the concrete empathy of an individual's life story and the strict authority of the underlying tax law.

5-3-2. Drafts of Flowcharts and Storyboards

Utilizing the logical elements extracted in Section 5-3-1, initial visual prototypes (Drafts) were generated. This phase aimed to experimentally validate the effectiveness of the visual layouts and expose latent design challenges. The prototypes were constructed as follows:

- **Flowchart Draft (Figure 5-8):** A monochrome, simplified line-art layout mapping the primary legal requirements and decision branches.
- **Storyboard Draft (Figure 5-9):** A comprehensive sequence of 10 hand-drawn illustrations comprehensively tracing the five-year chronological timeline of Case 2.

These drafts served as the critical foundational materials for the design finalization detailed in the subsequent section.

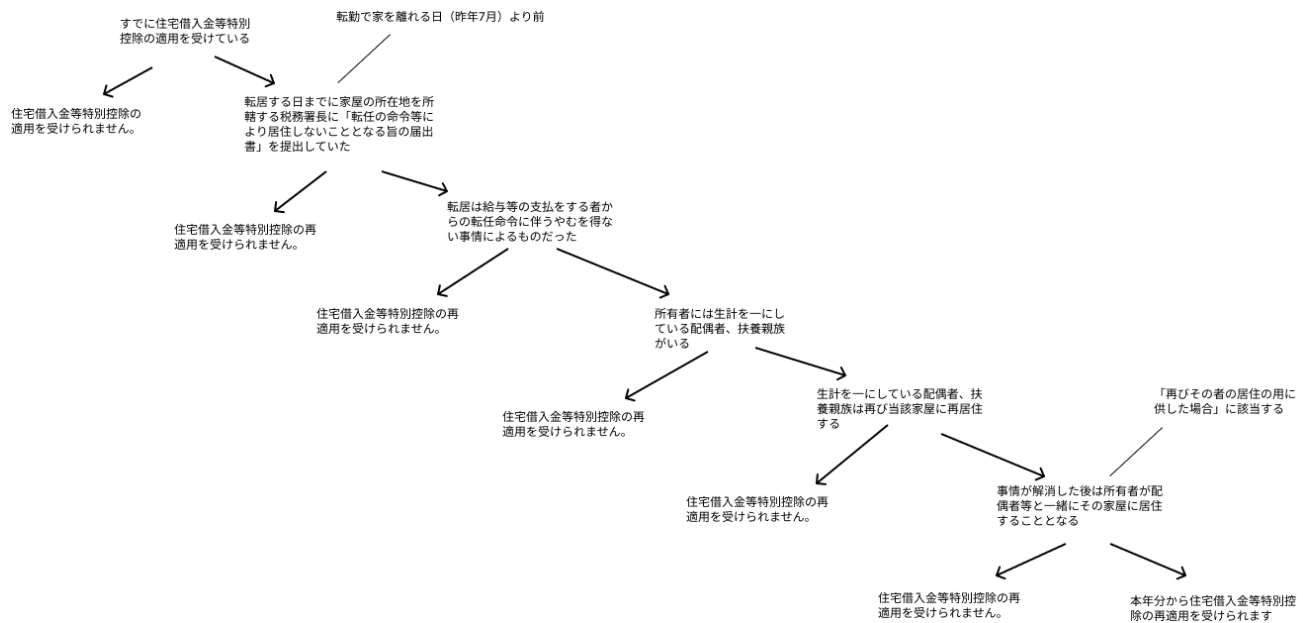


Figure 5-8. Initial flowchart draft featuring a monochrome and simplified line-art layout.

5-3-3. Critical Reflection

Evaluating the initial prototypes and their production processes exposed specific design bottlenecks unique to the flowchart and storyboard layouts. To resolve these issues and dismantle the historically negative, dry image associated with tax education in prior literature, a comprehensive Design Strategy was engineered.

Flowchart Optimization

Developing the flowchart prototype exposed the severe limitations of directly mapping the narrative structure used in existing official materials (such as the National Tax Agency website). As confirmed by the Macro-View analysis in Section 5-2, the STMA is structured such that core rules are immediately followed by an overwhelming volume of definitions and exceptions. To prevent the flowchart from merely duplicating this tedious linear reading, the layout was re-engineered around three core design directives to optimize practical decision-making for learners:

1. Chronological Reconstruction Based on Practice

The official National Tax Agency Q&A explains the system in statutory order, moving from STMA Article 41, Paragraph 28 (System Overview) to Paragraph 29 (Supplementary

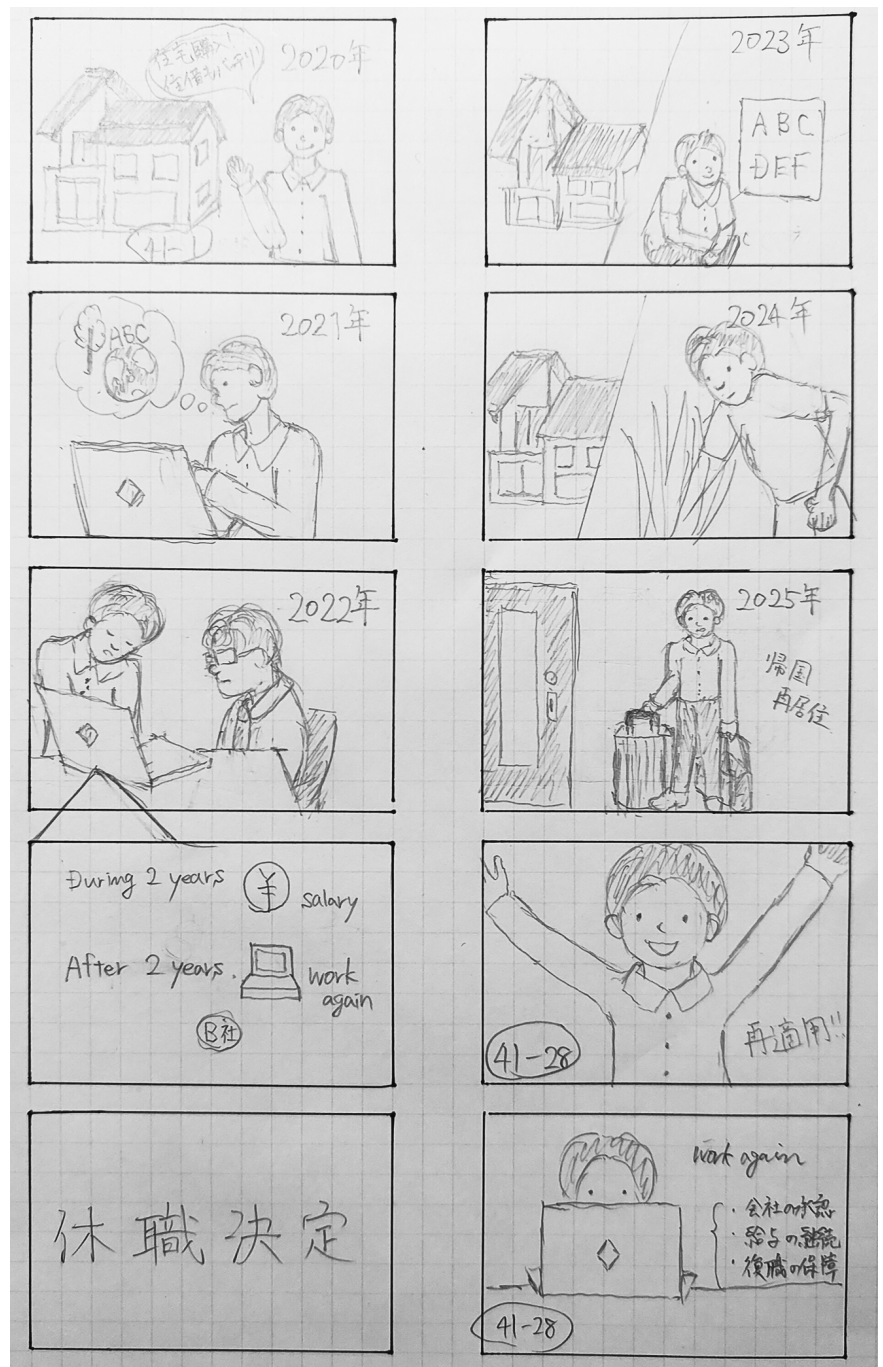


Figure 5-9. Initial storyboard draft consisting of a 10-panel hand-drawn sequence.

Requirements). However, when mapped onto a real-world practical timeline, "submitting the notification" (prescribed at the very end in Paragraph 29) is an action that must occur at the earliest stage—prior to vacating the home. Therefore, the flowchart abandons statutory clause order in favor of a practical, horizontal chronological flow from past to present. Furthermore, the initial draft directed every "No" branch to an isolated "Ineligible" endpoint, creating a chaotic web of lines across all six criteria. To optimize visual cleanliness, all "No" paths were consolidated into

a single, centralized "Ineligible" terminal node.

2. Contextual Annotations for Ambiguous Vocabulary

Statutory terms often carry contextual ambiguity. For example, the phrase "the date of relocation" can easily confuse learners as to whether it denotes the "first relocation" due to transfer or the "second relocation" upon returning. Anchored in Article 41, Paragraph 29 (up to the day the residence is vacated), the flowchart introduces explicit annotations defining this as the "first relocation," deploying a design intervention that prevents user misinterpretation.

3. Traceability to Legal Foundations

To ensure the visual diagram fosters strict legal comprehension rather than superficial understanding, authoritative statutory numbers were placed adjacent to every decision branch. This setup ensures learners can seamlessly return to the primary source texts to verify details. Concurrently, the scope of the legal foundations was expanded. While the official Q&A references only Article 41, Paragraphs 28, 29, and Circular 41-4, this framework explicitly incorporates Paragraph 30. Including this paragraph—which stipulates relief measures if a taxpayer forgets to file the initial notification—aligns the flowchart with real-world practice, creating a comprehensive decision-making model.

Storyboard Optimization

During the creation of the storyboard, the extended timeline of the case presented a major challenge: without clearly defining the narrative's boundaries, the number of panels would expand indefinitely. To solve this, the storyboard adapted the design philosophy used in the Macro-View—using shape and color to expose dependencies on external cabinet orders and statutes—by utilizing a systematic color-coding scheme for information. To optimize both scenario comprehension and statutory mastery, three modification directives were executed:

1. Optimization of Information Density

As identified in 5-3-1, the case unfolds over five years, initially requiring at least 10 panels to depict every detail. However, comparing this to pioneering legal design benchmarks like Vendor Power (2009) or the frameworks of Lee-Remond (2023), a 10-panel layout risks information saturation and increases cognitive load. The narrative was distilled to preserve only the essential legal milestones.

2. Synergy Between Visual Information and Text

Interpreting law requires both situational context and a precise understanding of how statutory criteria apply to that context. Illustrating every dry requirement inside the artwork causes visual crowding. Thus, following the layout architecture of Vendor Power, text blocks were integrated beneath the illustrations. By pairing a summarized version of the National Tax Agency's legal analysis with a narrative description of the scene, the design establishes a hierarchical layout that separates and parallelizes intuitive situational awareness and granular legal analysis.

3. Direct Integration of Statutory Evidence

To guarantee data integrity within a heavily visual narrative, the governing statutory clauses were anchored directly to each panel. Mirroring the Macro-View's approach of visualizing reference hierarchies, this structure establishes a visual alignment between concrete life episodes and abstract legal systems, enabling seamless user access to primary source texts.

Design Strategy

Mood boards for the flowcharts and storyboards were curated using assets collected from Pinterest. For the flowchart mood board, minimalist designs that maximized the legibility of Yes/No branching were selected. For the storyboard mood board, benchmarks including Vendor Power were integrated alongside illustration styles that effectively convey complex contexts and human emotions through simple line art.

Furthermore, a bright, low-saturation color palette was deployed

across all visualizations (Figure 5-10). This choice directly counters the reality noted by Sawada (2008) that tax education is traditionally perceived as uninviting, overly complex, and dry. By selecting a specific palette (e.g., #5E7F8F, #009EC0, #00AA9C, #DC4B87, #FEFEFE), the high-brightness tones project the clean, impartial, and transparent impression required of a tax system, while the soft, low-saturation hues dismantle the rigid, intimidating aura typically associated with state authority. Additionally, because the National Tax Agency frequently utilizes light green in its public relations (inspired by "e-Ta-kun," the green, computer-shaped mascot for the e-Tax system), this framework adopts a green-to-blue spectrum as its primary thematic color system.



Figure 5-10. Optimized color palette designed to mitigate the rigid perception of tax administration.

5-3-4. Final Refined Flowcharts and Storyboards

This section outlines the design executions and pedagogical benefits of the finalized flowcharts and storyboards.

Flowchart Execution

The final flowchart (Figure 5-11) design utilizes Interactive Questioning to prompt practicing learners to internalize the case as a matter of personal involvement:

1. Information Structure and Legibility

Each question is housed inside a diamond node—the universal standard symbol for flowchart decisions—ensuring immediate visual familiarity. While failing a single criterion renders re-application impossible, giving every question a separate "Ineligible" route would clutter the canvas. Thus, all "No" paths terminate at a single, unified destination ("You are not eligible for the reapplication of the credit"), reducing visual noise to a minimum.

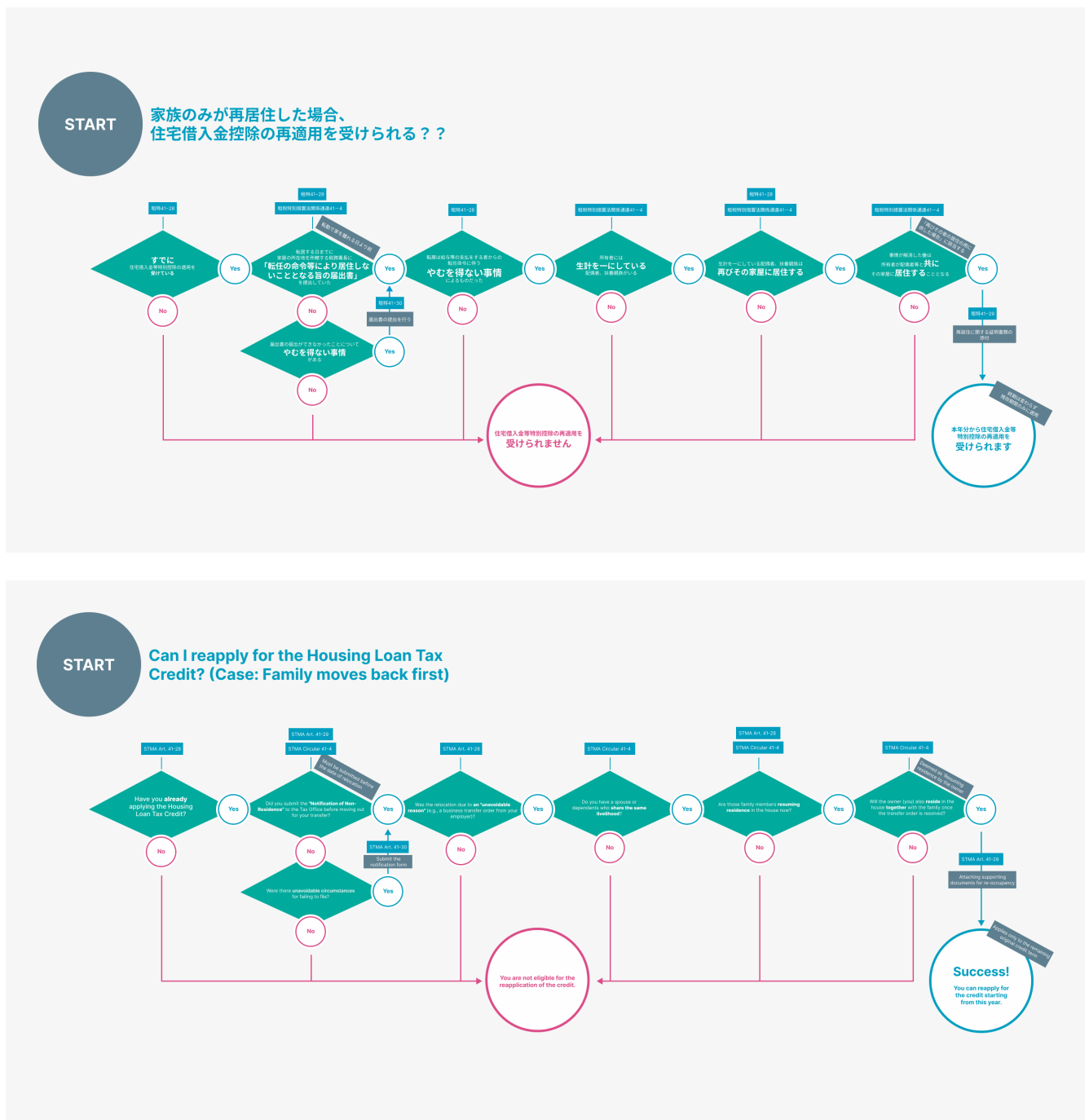


Figure 5-11. Final proposed flowchart for Case Study 1, shown in Japanese and English.

2.Horizontal Chronological Layout

Arranging the question nodes horizontally maps the passage of time directly to procedural progression. This alignment allows learners to intuitively grasp the required sequence of practical steps.

3. Layered Information and Rapid Access

Blue indicators displaying the governing statutory clauses are anchored above each question node, boosting traceability to primary law. Additionally, concise annotations clarify terms prone to misinterpretation directly next to the diamond nodes. This multi-layered layout enables learners to resolve ambiguities instantly on the flowchart without needing to consult external handbooks.

Storyboard Execution

The final storyboard (Figure 5-12) balances information accessibility with emotional resonance by executing the following layout principles:

1. Format Optimization

The sequence was consolidated into exactly six panels. This curation ensures that the entire storyboard fits perfectly onto a single A4 page when printed and eliminates excessive scrolling on digital devices, delivering a high-overview User Experience (UX).

2. Visual Communication Deployment

An approachable illustration style was selected, emphasizing the facial expressions of the characters (e.g., sorrow when vacating the home, joy when re-application is approved). This visual guidance allows learners to emotionally register the legal outcome before diving into the detailed text.

3. Advanced Content Summarization

The text area beneath each panel parallelizes the narrative plot with a highly structured breakdown of the National Tax Agency's criteria, as demonstrated below:

Why was it approved?

Employer's "Yes": Final decision by the company.

Full Pay: Salary & bonuses continued.

Job Security: Employee status was protected.

4. Visual Emphasis for Authority

Statutory references embedded within the narrative text are highlighted using red typography rather than the standard narrative blue. This treatment makes the legal evidence pop out of the storyline, simultaneously reinforcing data trustworthiness and visual findability.

Using the refined Macro-View and Micro-View visualization models developed in this chapter, Chapter 6 (Evaluation) performs a Qualitative Research assessment to evaluate the exact extent to which this legal visualization framework enhances a learner's comprehension of the STMA.



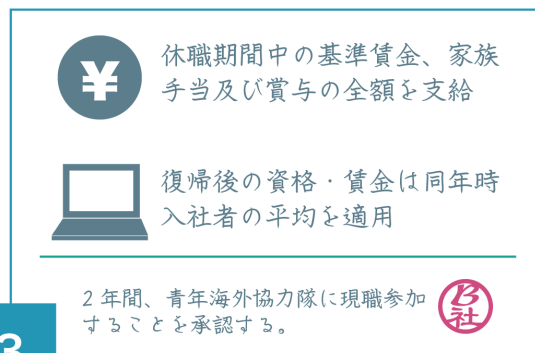
1

給与所得者の A さん（独身）は住宅を取得しました。夢のマイホームです。住宅借入金等特別控除の適用を受けました（**租税特別措置法 41-1**）。



2

住宅を取得してから、JICA の青年海外協力隊の参加に興味を持つようになりました。「仕事をやめずに参加できないかな……？」幸いにも、勤め先の B 社には、労使協議に基づいた現職参加に係る休職制度が確立されています。



3

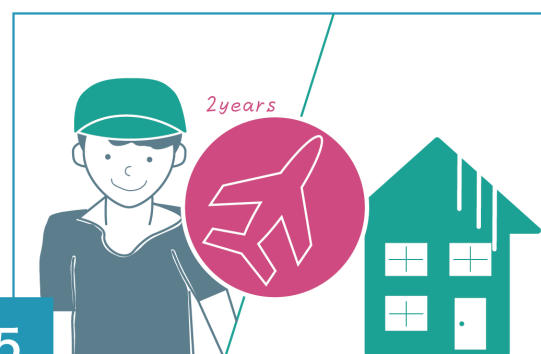
- 休職期間中の基準賃金、家族手当及び賞与の全額を支給
- 復帰後の資格・賃金は同年時入社者の平均を適用

2 年間、青年海外協力隊に現職参加することを承認する。



4

現職参加する 2 年間、A さんは住宅ともお別れです。独身の A さんには生計を一にする親族等を住まわせる予定もありません。住居は 2 年間、空き家になります。



5

青年海外協力隊として海外で充実した毎日過ごす A さん。ふと空き家が気になります。「海外在住中の今は住宅借入金等特別控除を受けていないけれど、帰国後には帰国した年から残りの期間の控除を再適用してもらえるのだろうか？」（**租税特別措置法 41-28**）



6

再適用が認められました！本ケースは実質的に「業務命令（出向）」と同等とみなされ、下記の点から「やむを得ない事由」（**租税特別措置法 41-28**）に該当します。

- 会社の承認（最終決定権が企業にある）
- 給与の継続（休職中も給与・賞与を全額支給）
- 復職の保障（従業員としての地位が継続）

Figure 5-12. Final proposed storyboard for Case Study 2, displayed as a bilingual spread in Japanese (left) and English (right).



Meet Mr.X, a single office worker who just bought a dream home. Life is good, and Mr.X is happily applying the Housing Loan Tax Credit to build a future. (STMA Sec. 41.1)



As time passes, Mr.X feels a growing passion to join the JOCV (JICA). "Can I do this while keeping my job?" A wonders. Luckily, Company B has a special leave system just for this kind of challenge.

¥

休職期間中の基準賃金、家族手当及び賞与の全額を支給

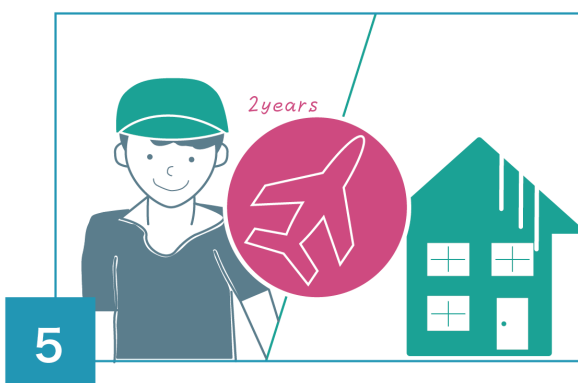
復帰後の資格・賃金は同年時入社者の平均を適用

2年間、青年海外協力隊に現職参加することを承認する。

With a nervous heart, Mr.X talks to the manager. The company says "YES!" and officially approves a 2-year mission. Mr.X is ready to embark on a journey as a volunteer, supported by the workplace.



The day of departure arrives. Mr.X says a quiet "see you soon" to the house. Since Mr.X lives alone, the rooms will stay empty and silent for the next two years, waiting for their owner's return.



While working hard abroad, Mr.X suddenly feels a flicker of worry. "I'm not getting my tax credit right now... but will I be able to get it back once I'm home for the remaining portion of the original credit period?" (STMA Sec. 41.28)



Success! Reapplication Approved. It was recognized as a "Business Order" equivalent. (STMA Sec. 41.28)

Why was it approved?:
Employer's "Yes": Final decision by the company.
Full Pay: Salary & bonuses continued.
Job Security: Employee status was protected.

Chapter 6.

Evaluation

Chapter 6.

Evaluation

6-1. Evaluation Methods

To verify the validity of the Macro-View methodology developed in Chapter 5, as well as to evaluate the Micro-View learning effects and subsequent shifts in learners' cognitive load, distinct evaluations were conducted for each dimension. The specific evaluation methods are structured as follows.

6-1-1. Structural Validation (Macro-View)

To verify the scalability and general applicability of the methodology established in Chapter 5, the framework was applied to additional legislative contexts beyond the initial scope of Article 41, Paragraphs 1 to 14.

For this case study, Article 41-2 of the STMA and Subsection 7-2 ("Special Provisions for Long-term Capital Gains on Replacement of Residential Property," encompassing Article 36-2 through 36-5) were selected. The primary objective of selecting these specific sections was to evaluate the methodology's performance when dealing with broader structural frameworks and varying legislative densities. Following the established methodology, bubble diagrams were generated for these provisions using the same extraction and scoring logic applied in the primary research phase, allowing for a comparative analysis of the resulting visual structures.

6-1-2. Qualitative Evaluation Framework (Micro-View)

As explored in Chapter 3, traditional legal communication relies heavily on natural language, which functions as a "linear" medium requiring sequential processing from the beginning of the text to the end (Robinson, 2009). Conversely, the law fundamentally functions as a complex, non-linear network of "conditions and effects." When applied to the STMA, this structural misalignment demands a high level of cognitive integration from legal learners; they must retain highly specific statutory requirements in their working memory while simultaneously navigating primary tax laws and complex, layered "exceptions to exceptions."

This misalignment forces learners to exert immense mental effort. The resulting extrinsic cognitive load hinders effective learning and practical application. To address this challenge, this study proposes the following concept and dual hypotheses:

- **Proposed Concept:** Providing visualizations aligned with the actual structural logic of the law allows learners to internalize and concretely simulate legal scenarios, thereby significantly reducing the mental effort required during legal study.
- **Hypothesis 1 (Cognitive Load):** When solving consecutive legal problems, the presence of visual aids will significantly reduce the learner's subjective cognitive load compared to text-only environments.
- **Hypothesis 2 (Performance):** For identical legal problems, the utilization of visual aids will improve task accuracy (correct answer rate) compared to traditional natural language text.

To validate these hypotheses, this study developed an independent evaluation framework adapted from the pedagogical methodology of Lee-Remond (2023), utilizing comparative group analysis and immediate recognition feedback. The experiment employs a dual-layer analysis design: a between-subject design to evaluate differences in performance accuracy across different groups, and a within-subject design to measure shifts in cognitive load within the same individual across different task formats.

Prior to administering the evaluation, three Key Performance Indicators (KPIs) were established for question design. The tasks incorporate both multiple-choice and descriptive formats (requiring the identification of specific articles and requirements) to replicate the rigor of professional legal examinations.

KPI 1: Findability

- **Method:** A scenario-based navigation task using National Tax Agency (NTA) Q&A case handling. Participants are observed as they locate specific provisions and procedural requirements within the STMA framework.
- **Objective:** To evaluate whether the proposed visualization functions as an effective navigation tool, enabling learners to efficiently access necessary information within a dense and complex legislative structure.

KPI 2: Comprehension & Insight

- **Method:** Case-based tasks focusing on identifying qualifying conditions, temporal structures (chronological application), and core legal issues derived from NTA Q&A scenarios. The tasks prioritize the extraction of underlying logic rather than superficial legal judgment.
- **Objective:** To assess whether the visualization supports the deep comprehension of contextual and structural dimensions within legal cases.

KPI 3: Cognitive Load

- **Method:** Self-assessment via a 5-point Likert scale measuring perceived mental effort, task difficulty, and the user's confidence level in their responses, complemented by time-stamp data retrieval.
- **Objective:** To compare the perceived cognitive load induced by natural language (traditional legal text) versus visualized methods.

Methodology of Qualitative Evaluation

The qualitative evaluation was conducted via Google Forms,

targeting a sample size of $n=13$ participants drawn from the target user group. Two variations of the questionnaire (Form A and Form B) were designed, each structured into four distinct sections: (1) Demographics, (2) Case Study 1, (3) Case Study 2, and (4) Self-Evaluation. Time-stamp queries were embedded between each section to capture precise response times for each task.

Furthermore, to identify the exact analytical pathway and informational heuristics utilized by the participants to derive their answers, an additional query was integrated into both Case Study 1 and Case Study 2, requiring participants to specify the primary resource they relied upon from four predetermined options: primary statutory texts, including laws, regulations, or administrative circulars; the proposed legal visualizations, such as flowcharts or storyboards; prior personal knowledge of tax or legal frameworks; or intuition and non-analytical reasoning. This specific methodological intervention was executed to empirically isolate the cognitive source of the participants' legal judgments, thereby verifying whether the correct answers and reduced processing times were directly driven by the visual treatments or external confounding factors.

While Form A and Form B share identical textual content, they alter the presentation of the visual aids to enable comparative analysis from two distinct dimensions (Figure 6-1):

Through this crossover design, the framework measures:

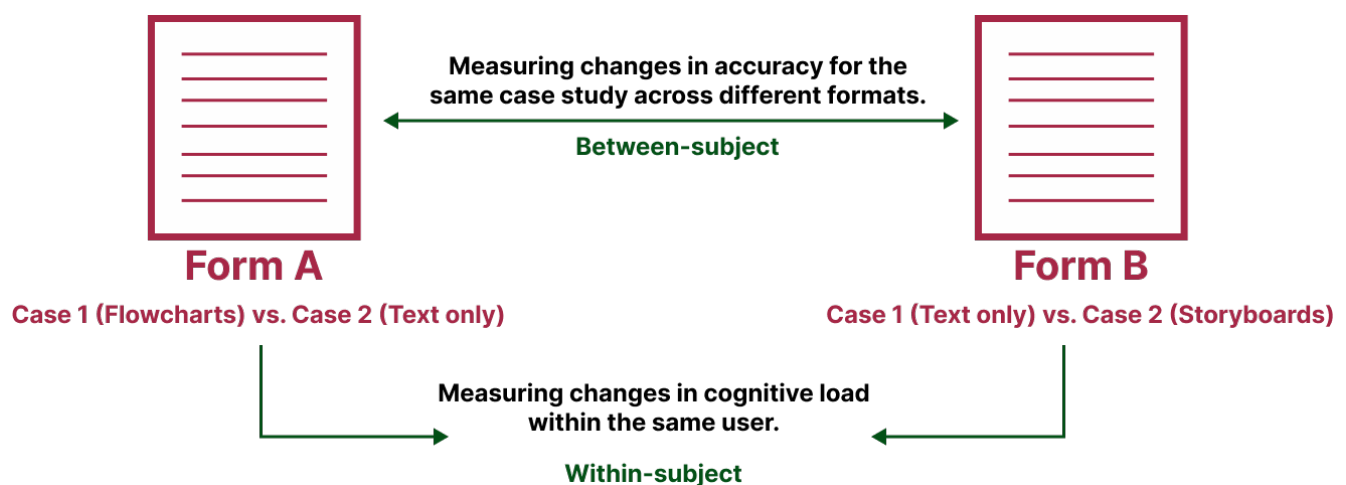


Figure 6-1. Overview of the comparative evaluation framework and questionnaire formats.

1. **Between-Subject Effects:** Comparing Form A and Form B for the same Case Study (e.g., Flowcharts vs. Text-Only in Case Study 1) isolates the effect of visualization on accuracy.

2. **Within-Subject Effects:** Comparing Case Study 1 and Case Study 2 within the same form isolates the fluctuation of cognitive load and confidence within individual users as they switch mediums.

The questionnaire structure allocates five questions per case study: two questions evaluate the accuracy of the legal conclusion, and three target the correct identification of statutory requirements. By mixing multiple-choice and descriptive formats, the test captures the depth of legal reasoning rather than mere guessing.

To ensure academic and practical rigor, the participants in this evaluation primarily consisted of national civil servants with extensive experience in statutory application (the author's professional colleagues), while concurrently incorporating a cohort of legal learners with diverse backgrounds (the author's acquaintances). Notably, this target group encompassed both individuals with prior experience studying tax law and complete novices to the subject.

Although the question formats are deeply rooted in Japanese jurisprudence education and are highly familiar to individuals studying law, all questions were drafted by the author and refined via Gemini to be deliberately calibrated to a high level of difficulty, assuming the participation of this expert tier in legal interpretation.

The rationale for targeting practitioners highly proficient in reading dense legislation, rather than exclusively focusing on novice learners, was to rigorously validate the robustness of the proposed visualization framework. The unique, multi-layered patchwork structure of the STMA imposes a severe cognitive load even on professionals accustomed to statutory interpretation. Therefore, if a significant reduction in cognitive load and an improvement in accuracy can be empirically demonstrated within this practitioner-centered group, it can be logically inferred that the framework will yield equivalent or even greater pedagogical benefits for legal learners (Legal Learners) across all proficiency layers. Furthermore, the inclusion of non-practitioner learners

serves as an invaluable sample design to simultaneously verify the general applicability and versatility of this visual paradigm, ensuring that the developed tool functions effectively for a broader reader base beyond a single specialized profession.

Furthermore, the design correlates the user's "Perceived Accuracy" (confidence level) with their "Actual Performance" to evaluate how effectively visualization mitigates mental friction and reinforces decision-making certainty. All questions—excluding demographics—are explicitly mapped to the KPIs (Figure 6-2).

Section	Question Topic	Primary KPI	Evaluation Objective
(1) Demographics	Gender, Age, Legal Experience, Work Habits	User Profile	To analyze how legal background influences performance.
(2) Case 1 (Family members only)	Q1: Re-application timing	02 Comprehension & Insight	Can they interpret "family return" as "deemed residence"?
	Q2: Treatment of period	02 Comprehension & Insight	Understanding the non-extension of the period.
	Q3: Pre-relocation procedure	01 Findability	Ability to navigate to temporal requirements (Notification).
	Q4: Forgotten notification	01 Findability	Finding and applying the "Exception to Exception" (Art. 41-30).
	Q5: Resolution of circumstances	02 Comprehension & Insight	Ability to extract logic from administrative circulars.
(3) Case 2 (JOCV Participant)	Q1: Legal status during assignment	02 Comprehension & Insight	Identifying the state of "loss of residence."
	Q2: Re-application timing	02 Comprehension & Insight	Extracting the logic of analogical application.
	Q3: Business order equivalence	01 Findability	Locating the link between JOCV and Business Orders.
	Q4: Crucial relationship factors	02 Comprehension & Insight	Identifying structural clusters (Salary/Reinstatement).
	Q5: Non-free will interpretation	02 Comprehension & Insight	Grasping the concept of "Corporate approval authority."
(4) Self-Evaluation	Task Ease (Comparison)	03 Cognitive Load	Direct comparison of perceived navigation ease.
	Mental Effort (Concentration)	03 Cognitive Load	Measuring "Mental Fatigue" per case type.
	Confidence Level (Accuracy check)	03 Cognitive Load	Comparing subjective certainty with objective accuracy.
	Effectiveness of Visualization	03 Cognitive Load	Measuring the user's perception of design utility.
Task Performance	Time-stamp Data	03 Cognitive Load	Objective measure of "Cognitive Friction" via duration.
	Information Source Attribution	Source Reliance	To quantify the degree of dependency on visual aids.

For instance, Question 5 in Case Study 2 presents the following problem:

Figure 6-2. Methodological framework correlating questionnaire topics with evaluation metrics.

Sample Question (Case Study 2, Q5)

Would participation in the Japan Overseas Cooperation Volunteers (JOCV)—essentially a volunteer activity—be deemed equivalent to a "Relocation Order (Business Order)"? Please state whether it is applicable and provide the reasoning, including the relevant statutory or circular reference numbers.

- **Model Answer:** Yes, it is deemed equivalent. Since the leave of absence is approved by the company, and treatment such as salary payments and guaranteed reinstatement is maintained, it falls under "other unavoidable reasons equivalent to these" as stipulated in Article 41, Paragraph 28 of the Special Taxation Measures Act. Therefore, it is treated as being equivalent to a business order.

The evaluation metrics for this specific task are mapped to the KPIs as follows (noting that tasks categorized under "Comprehension & Insight" inherently incorporate "Findability," as participants must first locate the correct provision cluster before executing logical interpretation):

KPI 1: Findability

While identifying the specific provision (Art. 41(28)) within dense legal text is time-consuming and cognitively demanding, the storyboard format enables users to locate the relevant provision instantly, as the article numbers are explicitly integrated into the visual narrative.

KPI 2: Comprehension & Insight

Interpreting whether a volunteer activity constitutes "unavoidable reasons" requires complex legal simulation when relying solely on text. The storyboard visualizes the essential boundary criteria, allowing users to reach the correct legal judgment through intuitive visual cues rather than exhausting mental deduction.

As demonstrated in the table below, every question in the evaluation framework was systematically mapped to specific KPIs to ensure a structured, metrics-driven analysis.

6-2. Data Analysis and Findings

6-2-1. Empirical Findings from Macro-View

Based on the developed methodology, two types of bubble diagrams were generated.

Case Study 1: Comparative Analysis of Article 41-2 (Figure 6-3)

The visualization of Article 41-2 was conducted to evaluate the consistency of the proposed methodology through a direct comparison with Article 41. In contrast to the forty paragraphs comprising Article 41, Article 41-2 consists of only four paragraphs, which is reflected in the smaller scale and

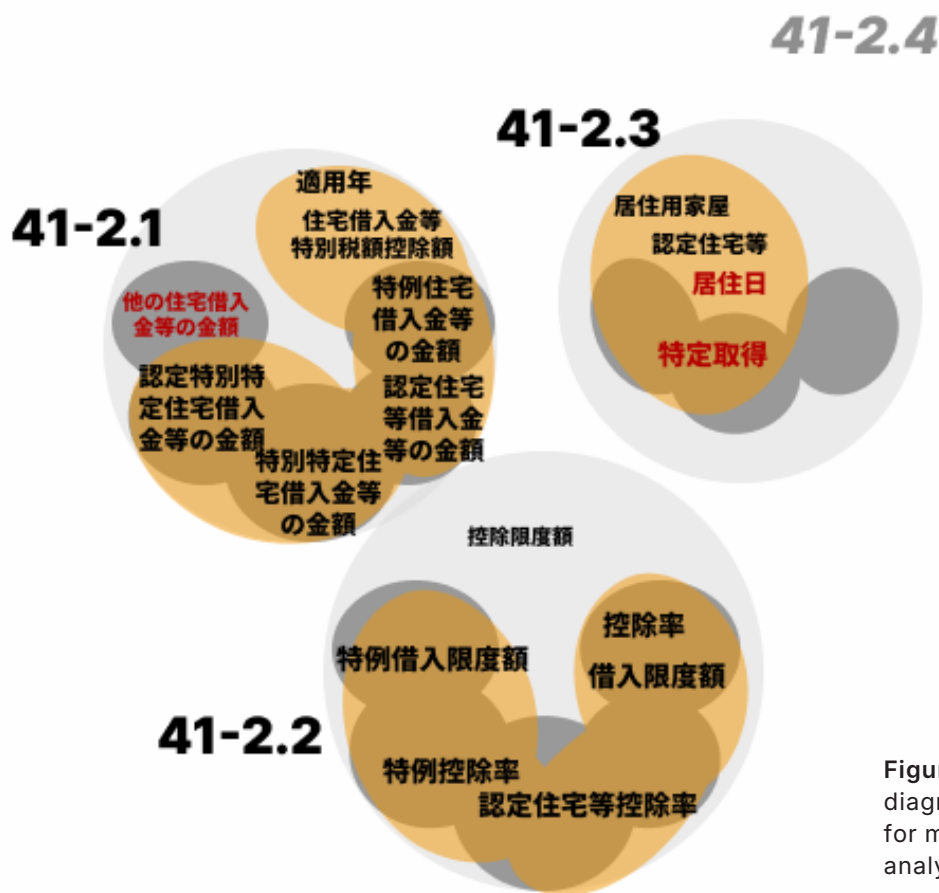


Figure 6-3. Macro-View bubble diagram of STMA Article 41-2 for methodological consistency analysis.

reduced diameter of the nodes within the bubble diagrams. Notably, Paragraph 4 contains no extracted terms, resulting in a representation that displays only the paragraph number in italics.

The analysis demonstrates that Article 41-2 is characterized primarily by internal dependencies within the STMA, exhibiting a remarkably low reliance on external statutes or cabinet orders. This structural pattern confirms its functional role as a supplementary provision designed to define specific exceptions to Article 41. This localized relationship is further evidenced by the recurrence of the term "Residential Housing" (居住用家屋); while this term serves as the primary node in Article 41(1), it reappears as a significant element within the more constrained scope of Article 41-2(3).

Furthermore, a distinct visual density is observed in Article 41-2(1). This "cramped" aesthetic is attributable not only to the significant character length of the legal terminology but also to the high degree of semantic similarity among frequently used

terms, such as "Amount of Special Housing Loans" and "Amount of Certified Housing Loans." The visual proximity of these analogous phrases underscores the cognitive challenge inherent in distinguishing specific kanji components within dense legal frameworks.

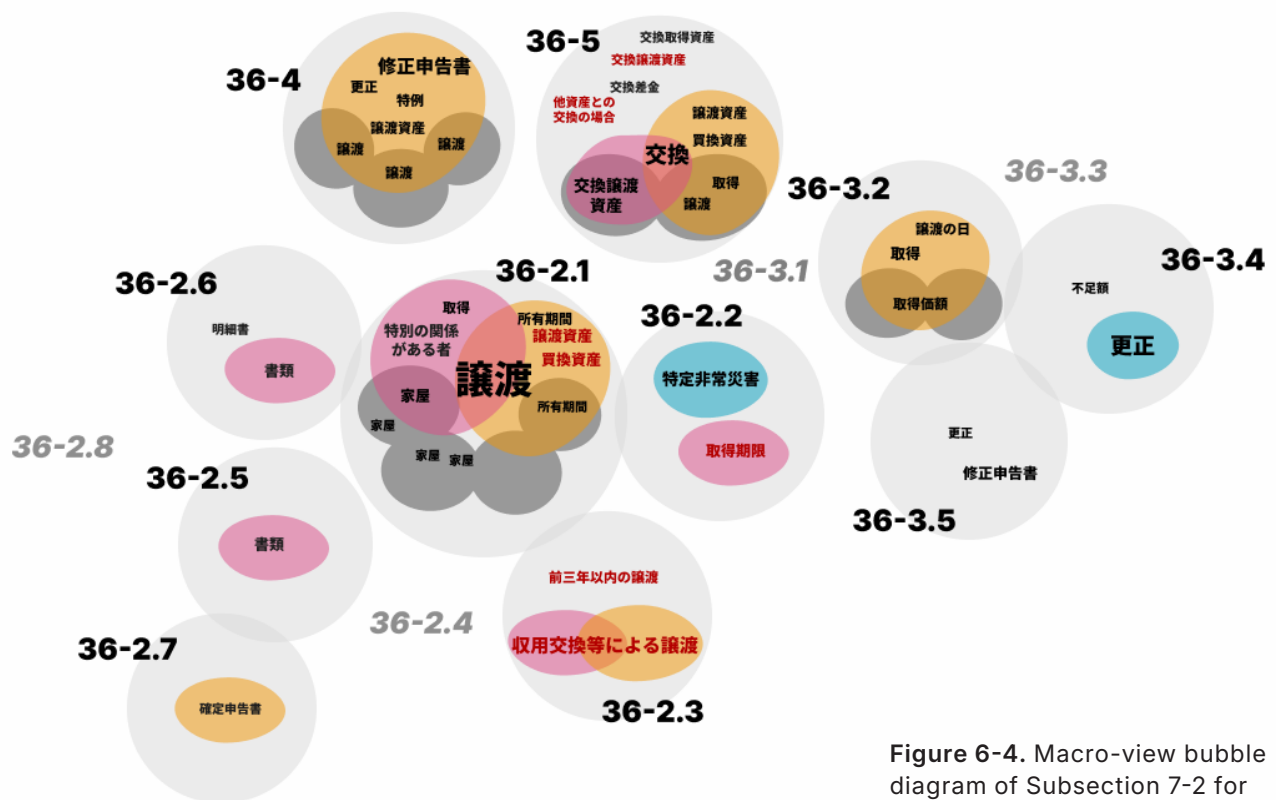


Figure 6-4. Macro-view bubble diagram of Subsection 7-2 for legislative scalability analysis.

Case Study 2: Structural Analysis of Subsection 7-2 (Figure 6-4)

To assess the scalability of the methodology across broader legislative units, the bubble diagrams were generated for Subsection 7-2 ("Special Provisions for Long-term Capital Gains on Replacement of Residential Property"). This subsection encompasses a continuous sequence from Article 36-2 to Article 36-5. Visualizing the subsection as a collective structural unit yielded several significant findings regarding the distribution of legal information.

Unlike Article 41, which features a singular, dominant focal point for practical study, Subsection 7-2 exhibits a more

distributed importance, with relatively uniform node sizes across its paragraphs. However, the qualitative significance of specific vocabulary is manifested through repetition across the section. For instance, the term "Transfer" (譲 渡) appears prominently in both Article 36-2(1) and Article 36-4, influenced by multiple external provisions and cabinet orders. This recurrence highlights how the methodology can identify critical nodes that serve as linguistic anchors across multiple sections.

Most significantly, the analysis reveals a "primacy effect" within the subsection's architecture. Similar to the concentration observed in Article 41(1), the visual data indicates that the initial provision—Article 36-2, Paragraph 1—serves as the primary structural anchor for the entire subsection. This concentration of internal and cross-sectional dependencies suggests that the opening segments of legal subsections often carry the highest functional weight, a characteristic effectively brought to light through the bubble diagrams methodology.

6-2-2. Structural Findings from Micro-View

To evaluate the effectiveness of the proposed Micro-View visualization models, an empirical evaluation was conducted utilizing Google Forms, yielding responses from 5 participants for Form A and 8 participants for Form B. All participants possessed prior experience in legal studies in some capacity, with approximately half (n=6) having specific experience in tax law. Regarding the frequency of reading statutory texts directly in professional or daily life, 12 participants selected either "frequently" or "occasionally," indicating that the cohort was generally accustomed to interpreting legal frameworks.

As previously established in Section 6-1-2 (Qualitative Evaluation Framework for Micro-View), while Form A and Form B shared identical textual content, they deliberately altered the presentation of the visual aids to enable a comparative analysis across two distinct dimensions. Specifically, Form A integrated flowcharts, whereas Form B incorporated storyboards. To ensure the reliability and validity of the evaluation data, all participating individuals were selected based on their prior academic or practical experience within the legal domain. Based on a

comprehensive analysis of these evaluation results, the following two findings were identified by hypothesis:

- **Hypothesis 1 (Cognitive Load):** When solving consecutive legal problems, the presence of visual aids will significantly reduce the learner's subjective cognitive load compared to text-only environments.
- **Hypothesis 2 (Performance):** For identical legal problems, the utilization of visual aids will improve task accuracy (correct answer rate) compared to traditional natural language text.

The model answers for each task were derived from the official interpretations provided in the National Tax Agency (NTA) Q&A case guidelines and were subsequently validated via AI to eliminate logical inconsistencies. Regarding the descriptive (short-answer) tasks, considering that the target legal learners included practitioners who might lack formal experience in academic law essay examinations, conformity to rigid jurisprudence essay formats did not influence the grading. Instead, responses containing the correct statutory interpretation and logical progression were evaluated as correct.

Scoring was assigned as 20 points for a correct answer, 10 points for a partially correct answer, and 0 points for an incorrect answer, from which the Accuracy Rate [%] was calculated. A "partially correct" designation was applied when a response contained correct core elements but failed to satisfy all required criteria. Examples included selecting two choices when only one was correct, selecting only one choice when two were required, deriving the correct conclusion but utilizing flawed interpretation in descriptive tasks, or providing the correct interpretation but omitting the final conclusion.

To ensure research transparency and data reproducibility, all empirical datasets have been systematically compiled into a Google Sheets titled 'Dataset(Micro-View)' as an appendix.

Verification of Hypothesis 1: Subjective Cognitive Load

The evaluation indicated that a majority of participants found it easier to locate answers in the sessions containing visual aids; Form A respondents favored Case Study 1 (flowcharts), while

Form B respondents favored Case Study 2 (storyboards).

In questions Q2 and Q3 of Section (4) Self-Assessment, participants self-evaluated their perceived mental fatigue on a 5-point Likert scale ranging from 1: Not tired at all to 5: Very tired. The mean scores were distributed as follows (Figure 6-5):

	Case Study 1		Case Study 2	
	Mental Fatigue	Self-Assessment Accuracy Rate [%]	Mental Fatigue	Self-Assessment Accuracy Rate [%]
Form A	3.00	64.0%	4.80	28.0%
Form B	4.25	40.0%	4.00	40.0%

Measured perceived mental fatigue using a 5-point Likert scale and analyzed shifts in self-assessment accuracy.

Note: 100% of all 13 participants selected either 'Strongly Agree' or 'Agree' regarding the utility of visual aids in reinforcing understanding.

For Form A, the mean fatigue score was 3.00 for Case Study 1 (with visualization) but rose significantly to 4.80 for Case Study 2 (text-only). For Form B, the score was 4.25 for Case Study 1 (text-only) and 4.00 for Case Study 2 (with visualization). These metrics demonstrate that the capacity of legal visualization to mitigate subjective cognitive load is remarkably pronounced in the flowchart format when compared both within the same subjects and across identical tasks.

Indeed, all five participants (100%) in Form A selected "Strongly Agree" for Q6 ("Do you think that using visual aids like storyboards or flowcharts would improve the understanding of tax laws?"). Conversely, the Form B cohort yielded three "Strongly Agree" and five "Agree" responses. Notably, two participants from the Form B group stated that they found it easier to locate answers in Case Study 1, which lacked visual treatments (Q1). This suggests that the storyboard modality possesses a more constrained capacity to reduce cognitive load, and its efficacy may vary or remain unperceived depending on individual learner characteristics.

Furthermore, regarding the "Primary Source Referenced" queries administered at the conclusion of each case study, it is critical to observe that even in sessions where visualization was provided, certain participants in both Form A and Form B groups

Figure 6-5: Measured perceived mental fatigue using a 5-point Likert scale and analyzed shifts in self-assessment accuracy.

bypassed the visual aids, relying exclusively on the primary statutory texts.

When comparing the Self-Assessment Accuracy Rates, Form A exhibited a drastic decline from 64.0% in Case Study 1 (flowchart present) to 28.0% in Case Study 2 (text-only). In contrast, the Form B cohort maintained a stagnant self-assessment rate of 40.0% across both case studies. As Hagan (2016) noted, "I wish every law class I learned was introduced with one simple overarching flowchart, that would show the essential tasks and questions that legal practitioners must proceed through when operating in this certain domain of law," prior literature heavily underscores the utility of flowcharts in visually navigating practical decision-making processes. The empirical results of this evaluation corroborate this stance, indicating that the flowchart effectively lowered cognitive load and reinforced participants' confidence in their selections post-task. This lower cognitive load associated with flowcharts aligns with McLachlan (2023), who utilized flowchart expressions and logical diagram symbology in developing "Lawmaps," identifying them as optimal for capturing the subtle nuances of logical progression within statutory and regulatory frameworks.

In conclusion, the verification demonstrates that introducing appropriate visual interventions can effectively lower the cognitive load exerted on legal learners interpreting complex statutory frameworks (supporting Hypothesis 1). However, this effect is highly contingent upon the visual modality employed, and individual variances persist regarding shifts in cognitive load and self-confidence.

Verification of Hypothesis 2: Task Performance from the Accuracy Rate and Time Spent

Figure 6-6 consolidates the metrics for objective Accuracy Rate, Self-Assessment Accuracy Rate, Primary Source Referenced, and Time Spent across the respective case studies.

A cross-group comparison between Form A and Form B revealed that the mean objective accuracy rates were superior in tasks embedded with visual treatments for both groups. However, a significant disparity in performance gains was observed

	Case Study 1			Case Study 2		
	Accuracy Rate [%]	Self-Assessment Accuracy Rate [%]	Time Spent	Accuracy Rate [%]	Self-Assessment Accuracy Rate [%]	Time Spent
Form A	80.0%	64.0%	20:30	48.0%	28.0%	15:48
Form B	62.0%	40.0%	28:08	68.0%	40.0%	17:25

Measured variables include objective accuracy rate, self-assessed accuracy rate based on post-task confidence, and time spent.
 Note: The average time spent on Case 1 for Form A was calculated based on four participants, excluding Participant 3's data (15:00:00) as an outlier.

between the two modalities. In Form A (Flowcharts), the mean accuracy rate reached 80.0% in Case Study 1 (visual present) but plummeted to 48.0% in Case Study 2 (text-only), representing a substantial 32% performance gap. Conversely, in Form B (storyboards), the mean accuracy rate was 68.0% for Case Study 2 (visual present) and 62.0% for Case Study 1 (text-only), demonstrating that the performance delta driven by storyboards was marginal compared to that of flowcharts.

Furthermore, within the Form B group, the mean Self-Assessment Accuracy Rate remained entirely unchanged at 40.0% across both case studies; only three participants exhibited an increase in self-perceived accuracy during Case Study 2, while others demonstrated a decrease. However, when evaluating performance by individual case studies, the groups with access to visual treatments outperformed the text-only groups by approximately 20% in both Case Study 1 and Case Study 2.

Regarding the time spent on tasks, substantial individual variances were observed, and the presence of visualization could not be statistically correlated with a direct reduction in task duration. This trend remained consistent even when isolating participants who explicitly designated "Visualization" as their primary referenced source. Crucially, however, multiple respondents in the text-only sessions recorded extremely brief task durations solely because they selected "I don't know" for all items. Correlating this phenomenon with the findings of Hypothesis 1 (Subjective Cognitive Load) indicates that the presence of visualization lowers the psychological barrier to complex legal analysis, preventing premature task abandonment and motivating learners to sustain problem-solving efforts.

Consequently, based on accuracy rate trajectories, legal

Figure 6-6: Measured variables include objective accuracy rate, self-assessed accuracy rate based on post-task confidence, and time spent.

visualization serves as an effective mechanism for improving statutory comprehension and accuracy in legal application (supporting Hypothesis 2). Nevertheless, its direct impact on performance efficiency, when measured strictly by task duration, remains inconclusive within this evaluation.

Verification of Hypothesis 2: Qualitative Analysis of Answers

To supplement the quantitative accuracy rates, this section executes a qualitative analysis of the verbatim text responses to evaluate how the architectural differences between flowcharts and storyboards altered participants' interpretive processes.

Flowchart Analysis

Example 1: Case Study 1 (Family-only Residence Case) Q3 (Multiple-Choice)

- **Question:** Which of the following legal procedures must be completed before the day the protagonist relocates? Please select all that apply.
- **Options:** Filing a tax return to receive the re-application of the "Special Credit for Loans Relating to a Dwelling." / Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc." / Submission of "Certifying documents regarding re-habitation (e.g., Certificate of Residence)" / I don't know.
- **Correct Answer:** Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."

Only three participants achieved a fully correct answer for this multiple-choice item (Form A: 1, Form B: 2; Form A contained 4 partially correct responses, while Form B contained 2 partially correct and 4 incorrect responses). However, the primary point of analysis is not the scarcity of correct scores, but rather the distinct divergence in error patterns between Form A participants (flowchart present) and Form B participants (text-only) (Figure 6-7).

The four partially correct participants in Form A uniformly selected the correct answer alongside the "Submission of certifying documents regarding re-habitation (e.g., Certificate of Residence)." Conversely, the six underperforming participants in Form B (partially correct and incorrect combined) overwhelmingly selected "Filing a tax return to receive the re-application..." Because filing a tax return cannot occur until after the day of re-habitation, this option represents a blatant chronological error that can be readily eliminated if the timeline of the case is structurally understood.

The Form A cohort, possessing a flowchart that visually delineated the chronological progression, completely avoided this timeline error. Instead, their errors were confined to selecting the re-habitation certificates (which are required for the post-return tax return, not prior to relocation). This error pattern likely stems from misinterpreting the flowchart's block for "Attaching supporting documents for re-occupancy" as a pre-relocation requirement, compounded by the prompt "Please select all that apply," which prompted users to assume multiple correct answers. Crucially, because the flowchart successfully reinforced the chronological boundaries, the filing of a tax return was eliminated

Participant Form	Example 1: (2)Case Study 1 (Family-only Residence Case) (3)
1 Form A	Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."/ Submission of "Certifying documents regarding re-habitation (e.g., Certificate of Residence)" .
2 Form A	Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."/ Submission of "Certifying documents regarding re-habitation (e.g., Certificate of Residence)" .
3 Form A	Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."/ Submission of "Certifying documents regarding re-habitation (e.g., Certificate of Residence)" .
4 Form A	Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."
5 Form A	Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."/ Submission of "Certifying documents regarding re-habitation (e.g., Certificate of Residence)" .
6 Form B	Filing a tax return to receive the re-application of the "Special Credit for Loans Relating to a Dwelling." / Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."/ Submission of "Certifying documents regarding re-habitation (e.g., Certificate of Residence)" .
7 Form B	Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."
8 Form B	Filing a tax return to receive the re-application of the "Special Credit for Loans Relating to a Dwelling."
9 Form B	Filing a tax return to receive the re-application of the "Special Credit for Loans Relating to a Dwelling." / Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."/ Submission of "Certifying documents regarding re-habitation (e.g., Certificate of Residence)" .
10 Form B	Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."
11 Form B	Filing a tax return to receive the re-application of the "Special Credit for Loans Relating to a Dwelling." / Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."
12 Form B	Filing a tax return to receive the re-application of the "Special Credit for Loans Relating to a Dwelling." / Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."
13 Form B	Filing a tax return to receive the re-application of the "Special Credit for Loans Relating to a Dwelling."
Correct Answer	Submission of the "Notification stating that the residence will no longer be used for habitation due to a transfer order, etc."

Figure 6-7: Grading and error distribution for Case Study 1, Q3. The text is color-coded to indicate Correct (Black), Partially Correct (Blue), and Incorrect (Red) responses, with Form A participants (visual present) highlighted in bold.

from their error domain. This demonstrates that flowcharts function as an effective cognitive safeguard against chronological misalignment.

Example 2: Case Study 1 (Family-only Residence Case) Q5 (Short Answer)

- **Question:** In a situation like this case, where the family returns to the residence before the protagonist, can it be legally determined that the "unavoidable circumstances due to the transfer have been resolved"? Please provide your reasoning based on the facts and relevant circular reference numbers.
- **Model Answer:** Yes, it can be so determined. Even though the family returned first, the fact that the protagonist is certain to return two years later meets the requirement of "when it is recognized that the individual will reside in the house together after the circumstances are resolved," as stated in Administrative Circular 41-4.

Only three participants from Form A achieved a completely correct score (20 points) for this descriptive task. In contrast, the Form B cohort yielded two partially correct and six completely incorrect responses. Although the direct textual answer to this question was not explicitly written out on the flowchart surface, the flowchart integrated a critical query block: "Will the owner (you) also reside in the house together with the family once the transfer order is resolved?" Selecting "Yes" dynamically routed the user to the step where re-application is approved. Consequently, as demonstrated by the Form A respondent below, participants were capable of deriving the correct structural interpretation of the "deemed resolution" clause directly from the visual logic of the flowchart.

- **Correct Participant Response (Form A):** *"It is possible to determine that the unavoidable circumstances have been resolved. In principle, according to the provisions of Article 41, Paragraph 28 of the Act, the above deduction does not apply unless the individual, A, returns from the relocation to the said house. However, by applying the Administrative*

Circular on the Act on Special Measures Concerning Taxation 41-4, the eligible persons are expanded beyond the individual A to include their spouse, dependents, and other relatives sharing a common livelihood. Furthermore, those persons are scheduled to use the said house for residence again, and A's relocation order is scheduled to be rescinded so that A will return to live with the spouse, etc., again. Therefore, the application of the above deduction is granted under this circular."

The following represent the typical underperforming responses from the text-only Form B cohort:

- **Partially Correct Response (Form B):** *"It cannot be said that 'the unavoidable circumstances have been resolved,' but under Circular 41-4, re-application is possible even if they have not been resolved."*
- **Incorrect Response (Form B):** *"It cannot be determined. Circular 41-4 merely establishes that when the individual's spouse or dependents use the housing for residence again... it does not go so far as to recognize the fact that the unavoidable circumstances due to relocation have been resolved."*

Both the partially correct and incorrect participants accurately identified "Administrative Circular 41-4" as the required reference source, indicating that Information Findability (KPI 1) was achieved even in a text-only environment. However, relying solely on natural language text, the partially correct respondents decoupled the conclusion from the premise (asserting that re-application is allowed despite the lack of resolution), while the incorrect respondents focused strictly on the isolated fact of the family's re-residence. They failed to synthesize the conditional connection highlighted in the flowchart—namely, that the guaranteed future return of the protagonist legalizes the current status as a "deemed resolution."

This indicates that flowcharts possess a profound capacity to visualize interlocking conditions and prerequisite structures that are easily overlooked when reading text alone, thereby guiding learners toward deep and accurate legal interpretations.

Storyboard Analysis

Example 3: Case Study 2 (JOCV Participant Case) Q4 (Multiple-Choice)

- **Question:** What elements regarding the relationship with the protagonist's employer (Company B) do you consider crucial for the re-application to be approved? Please select all that apply.
- **Options:** Salary is being paid during the period. / Reinstatement (return to work) is guaranteed. / The protagonist is single. / The protagonist had lived in the house for at least two years. / I don't know.
- **Correct Answer:** Salary is being paid during the period. / Reinstatement (return to work) is guaranteed.

This multiple-choice item mirrored the structure of Example 1. However, while the text-only group (Form A) extracted these core criteria from abstract statutory prose, the storyboard group (Form B) parsed the circumstantial narrative within the graphic panels. This task yielded seven correct respondents (Form A: 1, Form B: 6), indicating a definitive performance advantage for the storyboard modality.

This high accuracy is directly attributable to the storyboard's narrative design, which explicitly detailed the three mandatory operational criteria (corporate approval, salary continuation, and reinstatement guarantees) within the panel's caption text under the heading "Why was it approved?"

Conversely, the text-only Form A participants either selected only a single correct option or erroneously included the fact that "the protagonist had lived in the house for at least two years." This identical error pattern was also observed in the two partially correct respondents from Form B. Strikingly, these two Form B individuals explicitly noted in their "Primary Source Referenced" query that they relied on the "Text of laws, regulations, or circulars" rather than the storyboard. This confirms that reading the text in isolation caused users to misinterpret a case-specific factual condition ("living there for two years") as a universal statutory requirement.

Thus, when operating strictly within natural language text, extracting the essential criteria from abstract provisions remains highly challenging, leaving learners vulnerable to confounding narrative noise. The storyboard modality proves highly effective in mapping case-specific context to statutory requirements, thereby illuminating critical legal facts.

Example 4: Case Study 2 (JOCV Participant Case) Q3 (Short Answer)

- **Question:** Would participation in the Japan Overseas Cooperation Volunteers (JOCV)—essentially a volunteer activity—be deemed equivalent to a "Relocation Order (Business Order)"? Please state whether it is applicable and provide the reasoning, including the relevant statutory or circular reference numbers.
- **Model Answer:** Yes, it is deemed equivalent. Since the leave of absence is approved by the company, and treatment such as salary payments and guaranteed reinstatement is maintained, it falls under "other unavoidable reasons equivalent to these" as stipulated in Article 41, Paragraph 28 of the Special Taxation Measures Act. Therefore, it is treated as being equivalent to a business order.

This descriptive task yielded five correct responses (Form A: 1, Form B: 4) (Figure 6-8). The error distribution revealed that Form A (text-only) contained one partially correct and three incorrect responses, whereas Form B (storyboard present) was confined to three partially correct responses and only one incorrect response. This demonstrates that storyboards significantly reduced interpretive friction. For instance, a Form B participant who had previously scored a complete incorrect (0 points) in the text-only environment of Case Study 1 generated a highly precise legal argument when supported by the storyboard in this session:

- **Correct Participant Response (Form B):** *"It is determined. Article 41, Paragraph 28 of the Act on Special Measures Concerning Taxation mentions 'relocation accompanying a transfer order from the payer of salaries, etc., and other unavoidable circumstances equivalent thereto.' In this case,*

Participant Form		Example 4: (3)Case Study 2 (JOCV Participant Case) (3)
1	Form A	Based on Article 41, Paragraph 28 of the Act on Special Measures Concerning Taxation, if the participation in the Japan Overseas Cooperation Volunteers is strictly "while maintaining employment status" and the decision to participate was made against the background of "Company B's suspension-of-work system for maintaining employment status," there seems to be room for it to fall under "relocation accompanying a transfer order from the payer of salaries, etc., and other unavoidable circumstances equivalent thereto."
2	Form A	In this case, since it is for personal reasons, it is highly likely that it will not be determined to be equivalent to an "operational order (transfer order)."
3	Form A	It is not determined. Paragraph 28 of Article 41 requires relocation accompanying a transfer order from the payer of salaries, etc., or other unavoidable circumstances equivalent thereto. This case is a suspension of work based on the individual's own intention to participate in volunteering, which does not constitute a transfer order, and I believe it is not an unavoidable circumstance such as external factors like nursing care that are beyond the individual's control.
4	Form A	I don't know.
5	Form A	It is determined. Article 41, Paragraph 28 of the Act on Special Measures Concerning Taxation.
6	Form B	I could not find the relevant laws, regulations, or circulars, so I did not know.
7	Form B	Because it can be substantially deemed equivalent to an operational order from the viewpoints of the company's approval, continuation of salary, and guarantee of reinstatement in employment under the company's suspension-of-work system.
8	Form B	It is determined. Based on Paragraph 28 of Article 41, because the salary is paid even during the suspension of work, reinstatement is guaranteed, and the company holds the final decision-making power.
9	Form B	It is determined. Article 41, Paragraph 28 of the Act on Special Measures Concerning Taxation mentions "relocation accompanying a transfer order from the payer of salaries, etc., and other unavoidable circumstances equivalent thereto." In this case, participation in the cooperation volunteers is conducted with the approval of the workplace using the suspension-of-work system, and since salary payments continue and reinstatement is guaranteed, it can be considered equivalent to an operational order.
10	Form B	It falls under this. Based on Article 4.
11	Form B	The determination is whether it falls under "other unavoidable circumstances" in the clause "due to relocation accompanying a transfer order from the payer of salaries, etc., and other unavoidable circumstances equivalent thereto" in Paragraph 28. However, since the continuity of employment—such as the payment of salary during volunteer activities and the continuation of years of service—is established as a system in Company B, it is possible to determine that it falls under this definition.
12	Form B	It is recognized. [Quoted Statutory Text by Participant]: (28) In cases where an individual who had been subject to the provisions of Paragraph 1 ceases to use the residential housing... for their own residence due to relocation accompanying a transfer order from the person who pays salaries, etc.... prescribed in Paragraph 1 (referred to as the "payer of salaries, etc." in Paragraph 31) or other unavoidable circumstances equivalent thereto, and thereby becomes unable to apply the provisions of Paragraph 1, if they subsequently use these houses... for their own residence again, the application of the provisions of Paragraph 1... shall apply...
13	Form B	It is determined. In view of the facts that the enterprise holds the final decision-making power for participation, wages continue to be paid during the suspension of work, and reinstatement is guaranteed, A's participation in the cooperation volunteers is factually determined as having "ceased to use the residential housing... for their own residence due to relocation accompanying a transfer order from the person who pays salaries, etc., or other unavoidable circumstances equivalent thereto, and thereby became unable to apply the provisions of Paragraph 1" as prescribed in Article 41, Paragraph 28.
Correct Answer		Yes, it is deemed equivalent. Since the leave of absence is approved by the company, and treatment such as salary payments and guaranteed reinstatement is maintained, it falls under "other unavoidable reasons equivalent to these" as stipulated in Article 41, Paragraph 28 of the Special Taxation Measures Act. Therefore, it is treated as being equivalent to a business order.

Figure 6-8: Grading and error distribution for Case Study 2, Q3. The text is color-coded to indicate Correct (Black), Partially Correct (Blue), and Incorrect (Red) responses, with Form B participants (visual present) highlighted in bold.

participation in the cooperation volunteers is conducted with the approval of the workplace using the suspension-of-work system, and since salary payments continue and reinstatement is guaranteed, it can be considered equivalent to an operational order."

In contrast, the typical incorrect response from the text-only Form A group was structured as follows:

- **Incorrect Response (Form A):** *"It is not determined. Paragraph 28 of Article 41 requires relocation accompanying a transfer order from the payer of salaries, etc., or other unavoidable circumstances equivalent thereto. This case is a suspension of work based on the individual's own intention to participate in volunteering, which does not constitute a transfer order, and I believe it is not an unavoidable circumstance such as external factors like nursing care that are beyond the individual's control."*

Consistent with the errors observed in Example 2, these text-only participants successfully located the required statutory

provision (Art. 41(28)), satisfying KPI 1. However, they failed to transcend a literal, surface-level textual interpretation ("volunteering equals personal choice, therefore it cannot equal a business order"). They lacked the visual context necessary to evaluate the underlying socio-economic reality of the employment relationship (the corporate approval and financial continuity).

This validates that storyboards are highly effective at rendering the substantial legal nature of a scenario visible, utilizing illustration and narrative context to guide learners beyond rigid literal interpretations toward accurate legal evaluations.

6-2-3. Synthesis and Conclusion of Micro-View Evaluation

The quantitative and qualitative analyses collectively demonstrate that integrating legal visualization into the educational framework is highly effective for clarifying complex statutory requirements and structural dependencies.

In reference to the evaluation KPIs, Findability (KPI 1) did not exhibit significant variations based on the presence of visual aids; trained legal learners demonstrated the capacity to navigate dense legislative text to locate relevant provisions independently. However, in the domain of Comprehension & Insight (KPI 2), the impact of legal visualization was highly pronounced. By materializing structural layers such as chronological timelines and underlying operational criteria, visualizations enabled participants to bypass literal textual traps, yielding a substantial increase in objective accuracy and interpretive depth.

Nevertheless, the evaluation reveals an asymmetry in efficacy depending on the visual modality selected. Based on the mean accuracy trajectories and subjective cognitive load metrics, flowcharts demonstrated a clear architectural superiority over storyboards for tasks demanding rigorous chronological tracking and conditional logic execution. Furthermore, while the presence of visual treatments does not directly optimize efficiency in terms of Time Spent, it acts as a critical psychological buffer, mitigating cognitive exhaustion and preventing premature task abandonment when learners confront highly complex legal problems.

6-3. Critical Reflection on Design Iteration

6-3-1. Limitations of 2D Representation and Interactive Needs

As established during the initial exploration phase, legal frameworks are composed of highly diverse architectural elements. This study utilized a two-dimensional bubble diagram modality to visualize structural densities, focusing exclusively on core statutory terminology. Consequently, this model does not encompass the entire spectrum of legal components. While overlapping statutory scopes were represented via intersecting nodes, certain auxiliary provisions that exert external influence over the primary target articles fell outside the extraction logic of the current methodology.

To address these limitations, it is evident that two-dimensional diagrams are inherently restricted to lexical features. To model the comprehensive, multi-layered dependencies of an entire legislative body, future research must explore three-dimensional digital modeling techniques to represent structural relationships volumetrically.

Furthermore, while the lexical extraction and node scoring mechanics developed in this methodology are highly replicable, the specific layout configuration of intersecting circles remains partially dependent on the subjective design choices of the researcher. To standardize this execution, integrating digital interactive elements represents a necessary progression. For instance, a system could programmatically generate standardized independent nodes, while allowing users to dynamically manipulate and overlay the circles on an interactive interface. This fusion of three-dimensional representation and interactive user manipulation would allow for a highly precise and adaptive virtualization of the STMA's structural architecture.

6-3-2. Cognitive Disconnect in Legal Design

The capacity of legal visualization to serve as a cognitive bridge for learners encounters inherent constraints rooted in design conventions and institutionalized legal habits. A distinct

disconnect persists because legal learners lack systemic exposure to visual information design, and the fields of graphic design and jurisprudence prioritize divergent metrics when evaluating visual structures.



Figure 6-9. Syntactic structures of a legal sentence phrase: (left) information design approach, (right) official legal drafting guidelines.

This tension is clearly illustrated by the typographical layout of the Micro-View prototype, which incorporated the phrase: “ 本年分から住宅借入金等特別控除の再適用を受けられます ” (The re-application of the special deduction for housing loans can be received starting from this year). According to strict official legal drafting guidelines in Japanese, this sentence should naturally be organized as: “ 住宅借入金等特別控除の再適用を本年分から受けられます ” (The re-application of the special deduction for housing loans can be received, starting from this year)(Figure 6-9).

However, as identified during the Macro-View prototyping phase in Chapter 5, the standard verb-final (SOV) grammatical structure of the Japanese language—wherein the legal effect or conclusion is deferred to the absolute end of the clause—exerts an intense cognitive load during statutory interpretation. Because modifiers like “starting from this year” can be placed either before or after the object without destroying semantic clarity, non-statutory communication channels frequently employ a conclusion-first syntax to optimize information saliency. In this prototype design, to facilitate immediate contrastive analysis against the negative clause (“...受けられません”), the author deliberately placed the fluctuating condition (the applicable tax year) at the absolute front of the phrase to maximize visual contrast.

In response to this design intervention, a practitioner

participant provided the following feedback: *"In standardized legal drafting, the object clause should precede secondary modifiers, and prioritizing structural orthodoxy is crucial for legal certainty."* This interaction underscores a critical cognitive disconnect: legal learners routinely prioritize syntactic and formal grammatical exactness—as dictated by institutionalized legal drafting conventions—over visual saliency, legibility, and reduced immediate cognitive processing costs.

This professional expectation is further supported by another participant's feedback: *"I felt there could be a more distinct contrast in information presentation according to its level of importance, such as relegating unnecessary details for legal application to footnotes"*. These insights indicate that rigorous data filtering and structural hierarchy are mandatory. When designing legal visualizations for educational purposes, designers must actively assimilate user feedback to balance modern information design principles with the traditional linguistic expectations familiar to legal experts. Therefore, rather than merely imposing general UX/UI principles—such as a conclusion-first approach—onto the law, future legal design must strike a unique balance by maintaining the legal syntax that guarantees the rigor of statutory interpretation while effectively constructing a visual hierarchy.

Additionally, regarding aesthetic presentation, a Form B respondent noted: *"I think using characters or more catchy illustrations would attract the attention of the general public more effectively"*. If visual frameworks are to be deployed under the supervision of academic or governmental institutions, future iterations should explore incorporating highly recognizable institutional mascots or structured character designs to improve public engagement and lower the initial barrier to user interaction.

6-3-3. The Trust Dilemma of Legal Visualizations

A compelling paradox emerged regarding the Perceived Usefulness of Visual Aids: while 100% of the 13 participants selected either "Strongly Agree" or "Agree" validating the utility of the graphics, six participants explicitly bypassed the visualizations in sessions where they were present, designating alternative

sources as their "Primary Source Referenced." Specifically, five of these individuals relied strictly on the "Text of laws, regulations, or circulars" to resolve the tasks. This dual-track cognitive process is reflected in a participant's qualitative feedback: *"Although I tried to cross-reference the statutory text, the specific clause regarding 'transfer orders and other circumstances' in Diagram 2 was difficult to locate (I could not find it)."* This reliance on primary prose underscores a fundamental trust dilemma and a psychological barrier that limits the immediate adoption of legal design tools by trained learners.

Prior to the evaluation, the participants were informed of the author's professional background as an official of the National Tax Agency (NTA), and the instructions explicitly stated that the answers could be derived directly from the visual aids. Empirically, the only individuals to achieve a perfect 100% accuracy score across a case study were two Form B respondents operating with the storyboard in Case Study 2. These identical participants had scored only 40% and 60% in the preceding text-only session of Case Study 1, demonstrating that when visual aids are actively leveraged, they yield maximum pedagogical efficacy. This potential is further supported by positive user feedback: *"With the statutory text alone, almost nothing sank into my head, and it was extremely difficult to judge whether it applied to a specific, concrete case. Having the visual diagrams made the timeline and which laws applied to the case overwhelmingly easier to comprehend."*

Nevertheless, a robust cohort of legal learners instinctively defaults to natural language text due to a deeply ingrained trust in formal statutory prose. This anxiety is highlighted by another respondent's comment: *"Unless the guidelines for such interpretations and the underlying reasons are clarified, one can ultimately only react on a makeshift, case-by-case basis."* For these learners, navigating a visual diagram without explicit textual commentary induces an ad-hoc feeling, causing them to revert to text to guarantee legal certainty.

Consequently, the proliferation of legal visualization cannot rely solely on refining the visual clarity of the artifacts; it requires the simultaneous development of integration strategies that introduce visual tools alongside traditional textual sources. Furthermore,

because these prototypes were not explicitly branded or endorsed by an official regulatory or educational institution, the potential confounding factor that participants hesitated to trust a privately drafted visual framework must be taken into account.

6-4. Limitations of the Empirical Study

Regarding the Macro-View, the analysis was confined to a specific subsection of the STMA, and the visual architecture was restricted to a static, two-dimensional plane, failing to capture the multi-dimensional interdependencies of the broader legislative structure.

Regarding the Micro-View evaluation, three methodological limitations must be acknowledged. First, the limited sample size (n=13, with 5 in Form A and 8 in Form B) restricts the generalizability of quantitative metrics and precludes rigorous comparative statistical testing. Second, because the study was administered asynchronously via Google Forms rather than in a controlled, in-person environment, it was impossible to directly observe real-time cognitive pauses or behavioral friction, leaving the recorded "Time Spent" metrics susceptible to external noise such as network latency or unrecorded participant breaks. Third, the fixed task sequence—wherein all participants resolved Case Study 1 prior to Case Study 2—means that potential learning or sequential order effects cannot be definitively excluded.

However, despite the constrained sample size, the panel design deliberately targeted a highly specialized, expert-tier cohort of legal practitioners and advanced learners who routinely interpret dense, multi-layered statutes. Obtaining deep qualitative data and open-ended feedback from this population strongly reinforces the structural validity and interpretive reliability of the findings. Concurrently, the strategic inclusion of novice learners verifies the cross-layer versatility of the visual models, ensuring the framework remains robust for a broader reader base outside a single specialized profession.

Chapter 7.

Conclusion

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This research confronts the Special Taxation Measures Act (STMA), arguably the most labyrinthine component of the Japanese tax law system, by synthesizing legal scholarship with information design to deconstruct and visualize structural complexity and information asymmetry. Although originally enacted as temporary, time-limited legislation to serve specific socioeconomic policy goals, the STMA has undergone systemic expansion and hyper-complexity due to the entrenchment of political and economic vested interests, resulting in the institutionalization and perpetuation of exceptional measures. Through rigorous review of prior literature and authentic insights derived from practical experience within the National Tax Agency (NTA), this study demonstrates that the excessive cognitive load generated by this patchwork statutory architecture operates as the primary barrier obstructing taxpayer autonomy. To address this systemic challenge, this research identified legal learners—the intermediate tier of legal interpretation—as crucial gatekeepers. Consequently, a two-layered legal design framework consisting of a Macro-View (bubble diagrams) and a Micro-View (flowcharts and storyboards) was proposed and empirically evaluated to mitigate their cognitive friction.

7-1. Key Empirical Findings

The empirical evaluation conducted in Chapter 6, utilizing STMA Article 41 (Special Deduction for Housing Loans) as a core case study, elucidated both the efficacy and inherent boundaries of

the proposed framework, yielding definitive insights for the three central research questions (RQs).

Regarding the identification of effective visualization methodologies (RQ1), the macro-view bubble diagrams—driven by the "Impact Score" logic that quantitatively evaluates internal and cross-sectional statutory references—proved highly effective in exposing cognitive bottlenecks and highly dependent lexical nodes within dense legal prose.

Regarding the functional divergence between flowcharts and storyboards (RQ2), the empirical data validated Hypothesis 2 by demonstrating that each medium serves fundamentally distinct cognitive roles in complex tax interpretation. Flowcharts excel at facilitating the navigation of chronological, logical decision branches, operating as a vital cognitive safeguard that prevents interpretive errors, particularly the misinterpretation of temporal requirements. Conversely, while storyboards demonstrated limited utility in direct logical requirement extraction, they exhibited a unique capacity to visualize real-world employment dynamics and underlying socio-institutional contexts, thereby fostering "contextual empathy" and liberating users from rigid, overly literal textual entrapment.

Regarding accuracy gains and cognitive load mitigation (RQ3), quantitative metrics confirmed Hypothesis 2 by showing an approximate 20% increase in objective problem-solving accuracy within visual-assisted environments compared to text-only controls. Concurrently, the significant reduction in subjective mental fatigue and the corresponding elevation in self-confidence validated Hypothesis 1, confirming that visual interventions function as indispensable psychological scaffolds during complex task execution.

7-2. Theoretical and Practical Contributions

This study delivers substantial academic significance by merging law and design, establishing a theoretical framework that spatializes and externalizes the core essence of law—which operates fundamentally as a non-linear network of conditions and effects—thereby contributing to the development of legal design

as a cognitive infrastructure for statutory interpretation.

Practically, this methodology presents a potential contribution to Evidence-Based Policy Making (EBPM). While contemporary government statistics and reports remain largely constrained by raw numerical data, this data-driven visualization framework presents an approach that can assist in evaluating complex legislative systems themselves. Furthermore, this research reframes tax education in Japan—historically restricted to basic civic awareness for youth—into a pragmatic tool for adult legal literacy, exploring a scalable methodology to support the informational autonomy of taxpayers within a complex regulatory ecosystem.

7-3. Limitations and Future Work

While this research underscores the transformative potential of legal design, several systemic challenges warrant future investigation. First, to overcome graphical boundaries, the current bubble diagrams rely on static, two-dimensional planes that cannot fully encapsulate the multi-dimensional, dynamic interdependencies of the broader legislative architecture. Future work must leverage three-dimensional (3D) digital modeling technologies to represent statutory linkages volumetrically and spatially.

Second, to resolve the trust dilemma—wherein expert-tier cohorts instinctively revert to raw legal texts due to a rigid demand for absolute legal certainty despite highly praising the graphic interventions—subsequent design iterations must progress toward interactive, dynamic digital platforms. Rather than eliminating text, such platforms should allow users to click visual nodes to trigger pop-up interfaces displaying exact statutory provisions, administrative circulars, and judicial precedents, thereby bridging the cognitive disconnect between text and visualization.

Third, to scale up the evaluation beyond this exploratory, expert-focused pilot study (n=13), the extracted design rules, such as conclusion-first layouts and calibrated color spectrums, must be further optimized. Collaborating with official administrative and educational institutions will be essential to execute large-scale,

longitudinal quantitative assessments encompassing behavioral analysis through eye-tracking technologies across a broader, more diverse demographic of general taxpayers.

Ultimately, this methodological shift from merely reading the law to actively visualizing it establishes a vital precedent, contributing significantly to the realization of an intuitive tax communication environment that renders complex regulatory frameworks accessible and easily understandable for all citizens, regardless of their prior legal background.

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Appendix

- Dataset (Macro-View)

<https://docs.google.com/spreadsheets/d/1J5t4UY2hOit5kxWTh2e2L5GM6kILbKpTkzVr-8j-n8U/edit?usp=sharing>

- Dataset (Micro-View)

https://docs.google.com/spreadsheets/d/1tquSnSmPIHeSZYO0tcUy4aYpfdUO_dZD6Y4NL4fg9VM/edit?usp=sharing

