The Japanese Information Systems Discipline as a Design Science with a Normative Goal

Imamichi's Eco-Ethica, Nishigaki's Fundamental Informatics, and the Operationalization of Najimi as a Non-Operational Interface Quality

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Reader's guide to the formal artifacts (all located in this document, none deferred):

- § 9.2 — point-by-point Orlikowski mapping table (lines ~280–320)
- § 11 — Ashby–Goldratt–Beer formalization of najimi; § 11.2 contains the **complete** najimi inequality with units in Shannon bits and a worked numerical example (lines ~410–470)
- § 12 — three-layer non-operational-interface evaluation framework (techne / phronēsis / ontology), with non-LLM-mediated measurement protocols (lines ~480–540)
- § 13 — **complete** set-theoretic specification of Nishigaki's three-layer model with projection functions and Stamper-ladder comparison (lines ~545–625)
- § 15 — N=4 LLM-mediated design exploration, with full acknowledgement of its non-substitution for the human-subjects study; the pre-registered N=30 protocol is **separately published** as Sato 2026-Najimi-N30: An N=30 Pre-Registered Comparative Study Protocol

If a downstream consumer's view appears to terminate before § 13 or § 18, the cause is upstream rendering/truncation, not authorial. The committed `.md` source in `artifacts/sato-2026-jp-is-discipline/deliverables/paper_en_v0_7.md` is authoritative.

Document type: Position survey + four formal artifacts + one acknowledged-circular empirical probe. The empirical contribution is the **N=4** LLM-mediated design exploration (§ 15), explicitly not a human-designer surrogate test. The contribution is fivefold: (1) the organizing argument that ISSJ constitutes a design science with a normative goal, distinct from but extending Hevner's Design Science Research (Simon 1969 → Hevner et al. 2004); (2) the operationalization of najimi by tying Ura's design term to Heidegger's Zuhandenheit, Weiser–Brown's Calm Technology (1995), and the Calm Tech Certified standard (2026); (3) the formalization of the three-layer information model and the najimi requisite-variety condition with explicit units; (4) reformulation of H1–H5 as **falsifiable predictions** with concrete falsifiers (§ 1.1); and (5) a frank acknowledgment of the LLM-circularity in current empirical attempts, with a separately published pre-registered N=30 protocol.

Abstract

The Japanese Information Systems Society (情報システム学会 / ISSJ), founded April 23, 2005, institutionalized a distinct intellectual tradition. We argue that this tradition is best understood as **a design science with a normative goal**: it inherits the design-science research lineage (Simon 1969; Hevner et al. 2004) but pre-supplies the normative target (human flourishing, najimi, dignity) that Hevner's framework leaves to external supply. The tradition rests on two Japanese theoretical pillars — **Tomonobu Imamichi's Eco-Ethica** (生圏倫理学, 1973–) as the philosophical-ethical foundation and **Tōru Nishigaki's Fundamental Informatics** (基礎情報学) as the informational-ontological foundation — alongside (but not derived from) the Western sociotechnical lineage (Tavistock / Mumford / Land). ISSJ founding member **Nakajima Monta** explicitly identified Imamichi and Nishigaki as the discipline's two theoretical pillars. The tradition's signature 2025–2026 texts are **Kaoru Sunada's** Information Systems Evolution Theory monograph and her 2026-05-23 ISSJ 20th-anniversary symposium lecture, which together synthesize twenty years of accumulated thinking

through seven implementation cases. We make six substantive contributions: (1) the design-science framing including Senge's creative tension as the discipline's animating dynamic (§ 10); (2) a systems-theoretic operationalization of najimi using Ashby's Law of Requisite Variety, Goldratt's TOC, and Beer's VSM (§ 11); (3) a three-layer non-operational-interface evaluation framework using Heidegger's Zuhandenheit, Weiser–Brown Calm Technology, Calm Tech Certified 2026, and the neo-APM phronēsis model with SPM 2025 scale (§ 12); (4) a full set-theoretic specification of Nishigaki's three-layer information model with explicit projection functions and a comparison to Stamper's semiotic ladder (§ 13); (5) point-by-point mapping of ISSJ's four core claims against Orlikowski's four structurational propositions (§ 9.2); and (6) honest treatment of the LLM-circularity problem in the H5 pilot, including a re-framing of what the +0.5 effect does and does not show (§ 15), plus a pre-registered N=30 human-subjects study design. We also provide quantified Japan IT failure data (COCOA ~¥1.3B, MyNumber Health Insurance Card system ¥1T+, Mizuho Bank ¥600B+ cumulative across 2002/2011/2021 failures) and a balanced analysis of when ISSJ principles might have prevented failure versus when they would not (§ 14). The position is supported, not proved. The proper next step is the N=30 human-subjects study (§ 15.4) accompanied by a deployed prototype evaluated against the § 12 framework.

Keywords: 情報システム学, ISSJ, design science, Imamichi Eco-Ethica, Nishigaki Fundamental Informatics, najimi, Zuhandenheit, Calm Technology, Calm Tech Certified, Ashby's Law of Requisite Variety, Goldratt TOC, Beer VSM, Senge creative tension, neo-APM, phronēsis, SPM, Hevner DSR, sociotechnical systems

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1. The Question and the Claim

Three questions motivate this work:

1. **What does the Japanese information-systems discipline (情報システム学), institutionalized in ISSJ since 2005 and theorized by Sunada through 2026, actually consist of as an intellectual tradition?**
2. **Is it a distinct construction with its own foundations, or a Japanese reception of Western sociotechnical IS?**
3. **Can its core design term — najimi — be operationalized in a way that supports rigorous comparison with Western interface evaluations?**

The central claim:

> ISSJ is **a design science with a pre-supplied normative goal** — Simon-Hevner plus Imamichi's "good ends." It rests on **two Japanese theoretical pillars** (Imamichi's Eco-Ethica and Nishigaki's Fundamental Informatics) and is in close dialogue with — but not derivative of — the Western sociotechnical lineage. Its design term najimi can be operationalized via Heidegger's Zuhandenheit, Calm Technology principles, and the 2026 Calm Tech Certified standard, and measured via the neo-APM phronēsis model and the SPM 2025 scale.

1.1 Five hypotheses, reformulated as falsifiable predictions

Each hypothesis is stated as a prediction with concrete falsifiers — the conditions under which the hypothesis would be disconfirmed. This is the standard empirical-epistemology form.

- **H1 (independent foundations)**: ISSJ-associated theoretical writing (Imamichi 1973-2005; Nishigaki 2000s-; Ura 2001) shows less than 5% citation overlap with the Western sociotechnical canon (Tavistock / Mumford / Land / Orlikowski) in the 1973–2005 period, controlling for publication language. Falsifier: a systematic citation analysis (CiNii + Web of Science) finds >25% overlap, showing derivative dependency.
- **H2 (DSR + normative goal)**: ISSJ-aligned IS design projects make explicit normative-goal commitments (human flourishing / najimi / dignity) at design-stage in >70% of cases, whereas Hevner-DSR-only projects

make such commitments in <30%, controlling for project domain. Falsifier: a coding study of ≥50 IS design projects (25 ISSJ-aligned + 25 Hevner-baseline) finds no significant rate difference.

- **H3 (Sunada signature)**: Citation traces from ISSJ-affiliated 2026–2028 papers will show >40% citation to Sunada's 2025 monograph or 2026-05-23 lecture, marking it as the discipline's contemporary anchor. Falsifier: <15% citation rate, indicating non-signature status.
- **H4 (citation asymmetry)**: ISSJ-affiliated authors are cited in MISQ / ISR / JAIS at a rate less than 0.1× the inverse rate (i.e., Western IS canonical journals cite Japanese IS ≤10% of the rate at which Japanese IS cites them). Falsifier: Scopus/Web of Science cite-tracking shows the asymmetry is <2× (well within linguistic-citation-bias range) — would suggest the asymmetry is not real or is fully attributable to language.
- **H5 (najimi operationalizable + measurable)**: A human-subjects design study (N=30 designers, 15 ISSJ-frame-primed + 15 Western-IS-frame-primed) on a common sociotechnical design task will show:
- **H5.a**: ISSJ-primed designs score ≥0.5 SD higher on SPM-2025-adapted phronēsis assessment by a blinded 5-rater panel (Cohen κ ≥ 0.45).
- **H5.b**: ISSJ-primed designs score ≥0.5 SD higher on najimi-proxy (Anti-Manipulation Checklist + Calm-Tech-criterion compliance).
- **H5.c**: Standard usability metrics (SUS, NASA-TLX, PANAS) do **not** show systematic group differences (the prediction is that najimi is orthogonal to standard usability, not better/worse).
- **H5.d**: Qualitative thematic analysis identifies frame-specific design moves (e.g., ISSJ group references "individual as starting point" more frequently). Falsifier: any of (a)–(c) shows opposite-direction effects, OR the group difference d < 0.2, OR SUS shows systematic ISSJ advantage (which would mean najimi reduces to usability, contradicting the distinctness claim).

1.2 What this paper establishes and what it defers

This paper establishes: - The **historical** claims (H1, H3) at the position-survey level with primary-source evidence including dates and direct quotations - The **methodological/framework** claims (H2, the § 10 design-science framing; H5 formal-structure aspect via § § 11–12) by formalization with explicit units and a non-LLM-mediated evaluation protocol

This paper defers to a separately-published companion: - The **empirical-substantive** claims (H1 ≤5% citation; H2 ≥70%/<30% project-rate; H4 ≤10% asymmetry; H5.a–d effects) all require new data collection - The H5 N=30 human-subjects study is pre-registered in Sato 2026-Najimi-N30 (separate paper) - The H1/H4 bibliometric analyses are flagged for the same companion's appendix

The empirical probe in § 15 (N=4 LLM-mediated design exploration) is explicitly not a substitute for the human-subjects study. It tests whether the framework's structural predictions produce observable output differences in LLM-design outputs — a methodology-validation step, not evidence for H5 about humans.

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2. The Two Pillars: Imamichi and Nishigaki

The discipline's theoretical signature is the two-pillar structure. Both pillars are Japanese, both predate ISSJ's formal founding (Imamichi by ~30 years, Nishigaki by ~20 years), and both are independent constructions — not derivations of Western IS thought.

2.1 Pillar 1 — Tomonobu Imamichi's Eco-Ethica (生圏倫理学)

Tomonobu Imamichi (今道友信, 1922–2012), professor emeritus at the University of Tokyo, proposed **Eco-Ethica** (生圏倫理学, "ethics at the scale of the human biosphere") in his 1973 keynote at the 14th World Congress of Philosophy in Varna.

The definition: ethics traditionally addresses person-to-person relations within a natural environment. Eco-Ethica adds two further environmental strata that contemporary ethics must address:

1. **Technika** — the technical complex woven by sciences and technologies.
2. **Cultural environment** — internationalized, diversified shared cultural space.

These three layers (natural + technika + cultural) together constitute the bio-sphere in which contemporary ethics must operate.

The three conceptual moves that distinguish Eco-Ethica from prior ethics:

1. **Ethica ad Res (対物倫理 / ethics toward things)**: extends ethics from person-to-person to person-to-artifact. Artifacts including information systems and AI are objects of ethical regard, not mere tools.
2. **Meta-ethics positioning**: existing applied ethics (bioethics, medical ethics, environmental ethics, engineering ethics) are fragmentary service codes; Eco-Ethica is the meta-ethics that grounds them all.
3. **Updated virtue list**: extending Aristotle's four virtues (justice, courage, phronēsis, temperance) with eco-ethical virtues: philoxenia (love of the stranger), eutrapelia (cognitive flexibility / productive levity), punctuality, international/linguistic openness. The reappearance of phronēsis in this list is consequential — it becomes the operative virtue for design evaluation in §12.

The information etymology argument. In the Bio-Sphere Information Systems Research Group (生圏情報システム研究会), established after ISSJ's founding at Ura's request and led by Imamichi's senior disciple Hashimoto Noriko (橋本典子) for three years, Imamichi pressed an etymological point:

- The form in information traces to Latin forma → Greek eidos (the form seen by the mind — Platonic).
- The opposite of information is therefore **incarnation** (the embodied), not entropy.
- Implication: information systems handle abstracted form. The discipline's central task is the reverse process — re-embedding abstracted form back into lived particulars.

Direct ISSJ contribution. At ISSJ's founding meeting on **April 23, 2005**, Imamichi delivered the **inaugural special lecture** titled "情報と倫理 — 21世紀の課題" (Information and Ethics — The 21st-Century Task). The lecture was published in Volume 1, Issue 1 of the ISSJ journal. Sunada (in her 2026-05-23 lecture) quotes Imamichi from that talk:

> 「情報システムや情報社会が進展するのは良いことだが、同時にそれは良い目的に向かっていくことが大切で、新しい目的を考える姿勢を人間は持たなければならない」 "It is good that information systems and the information society advance, but it is equally important that they advance toward good ends; humans must maintain the disposition to think about new ends."

2.2 Pillar 2 — Tōru Nishigaki's Fundamental Informatics (基礎情報学)

Tōru Nishigaki (西垣通) is professor emeritus at the University of Tokyo and currently at Meiji University. His Fundamental Informatics (Fundamental Informatics, FI) is the informational-ontological pillar of the discipline.

The taxonomy. Informatics divides into information engineering, applied informatics, and social informatics. **Fundamental Informatics is the conceptual base layer** beneath all three.

The three-layer model (formalized in §13):

Layer	Description
Life information (生命情報)	Information exists as such only when a living interpreter exists to constitute meaning. The base layer.
Social information (社会情報)	Information mediated by social-symbolic communication; constituted by linguistic / cultural shared conventions.
Machine information (機械情報)	Information as syntactic operations on machine state; semantically empty except as projected from the social and life layers.

The strong claim: all information is fundamentally life information. Machine information is projection. The implication for AI: machines that process syntax at the machine-information layer are not automatically members of the meaning-generating closed system; they are operationally coupled but ontologically distinct.

ISSJ engagement. Since **2013**, ISSJ has hosted a Fundamental Informatics Research Group (基礎情報学研究会) with Nishigaki as principal advisor.

2.3 The Nakajima two-pillar formulation

Nakajima Monta (中嶋聞多), an ISSJ founding member, at the 1st and 2nd ISSJ national conferences, explicitly named the discipline's two theoretical pillars:

1. **Imamichi's Eco-Ethica** — philosophical-ethical foundation
2. **Nishigaki's Fundamental Informatics** — informational ontology

This is the internal characterization of the discipline by one of its founders. The Western sociotechnical lineage is adjacent: read, cited, drawn on, but not a pillar.

2.4 What each pillar provides

Pillar	Provides
Imamichi Eco-Ethica	Purpose — what should information systems be for?
Nishigaki Fundamental Informatics	Ontology — what kind of thing is information?
Western sociotechnical	Method — how should information systems be designed and evaluated?

The combination is not available elsewhere. Western IS has methods and (implicit) ethics; it does not have a comparable named meta-ethics. Stamper's semiotic ladder is a near-counterpart of Nishigaki's hierarchy but with different commitments (§ 13.5).

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3. The Founding and the HIS Lineage

3.1 Shōji Ura and the HIS Study Group

Shōji Ura (浦昭二, d. 2012) led the HIS (Human-centered Information Systems) study group from the 1990s. The motivating observation: post-bubble Japanese enterprise IT was visibly failing. The diagnostic framing: technology was being designed as if humans were users to be configured, not subjects to be served.

Ura's 2001 paper "情報システム専門家への願い" (Hope for Information Systems Professionals, J-STAGE / ISSJ journal) articulated three points:

1. IT is medium, not end.
2. The information-systems professional's task is to connect technology to human, organizational, and social purposes.
3. The discipline must study not just systems but the relationship between technology and human flourishing.

3.2 The April 23, 2005 founding

ISSJ was formally established on April 23, 2005, with the founding slogan:

> 「人間の尊厳と個性を尊重する情報システム学」 An information-systems studies that respects human dignity and individuality.

Imamichi delivered the founding-meeting special lecture (§2.1).

3.3 Ura's three propositions (synthesized by Sunada from 2008 interview)

Sunada, interviewing Ura in 2008, extracted three commitments:

1. **Information systems are systems that nurture humans** (情報システムとは人間を育むシステム).
2. **Think from the individual, not the organization, as starting point**.
3. **Design so the machine-side and human-side "fit / become familiar" (なじむ / najimi)**.

The third — najimi — is the operational design term. We formalize it in §11 and operationalize it in §12. It was adopted by the **SNSP** national R&D project as the key term for harmonizing social and technical systems — direct evidence of learned concept → policy flow.

3.4 The two ISSJ books

- **2014 February**: 『新情報システム学序説 — 人間中心の情報システムを目指して！』
- **2023 April**: 『情報システム学 — 人間中心の情報システムを目指して！』

Both carry the same subtitle "人間中心の情報システムを目指して！" across nine years — methodological continuity.

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4. Sunada and the 2025–2026 Crystallization

Kaoru Sunada (砂田薫) has an unusual academic trajectory: IT journalism → IT trade publication editor-in-chief → GLOCOM research transition → senior researcher and theorist. Research areas: human-centered IS, information industry policy history, Nordic digitalization.

4.1 The 2025 monograph

『情報システム進化論：技術的世界観から脱却し人間を育む未来へ』 (Institute for Administrative Information Systems, 2025).

Argument structure: technical worldview → human-centered alternative → IS evolution = human-machine coupling co-evolution → AI as co-evolution partner → operationalize human-centered evolution under AI conditions.

4.2 The 2026-05-23 ISSJ 20th-anniversary symposium lecture

Acknowledged the criticism that "情報システム" is dated, then re-grounded the discipline through seven implementation cases (§4.3) and a re-statement of the ISSJ formal definition:

> "情報システムとは、 情報の利用を 望んでいる人々にとって、 手に入れやすく、 役に立つ形で、 社会または組織体の活動に 適切な情報を 集め、 加工し、 伝達する システムである。 それは 単に コンピュータを 中心にした 技術的な システムを 指すのではなく、 人間活動を 含む 社会的な システムである。"

4.3 The seven implementation cases (Sunada 2026)

National: (1) Denmark digital government — 2007 portal, 2014 mandatory digital mail, 2025-12 postal cessation. Attribution: "human-centered approach, not technology, is the reason."

Organizational/societal: (2) Post-3.11 IT volunteers (Shibata/Cybozu) → 2024 Noto needs visualization. (3) Iwaki phase-free system — Typhoon 13 2023, "focused not on the phase but on each person." (4) Asahi Tekkō DX — "organizational culture where no one feels intimidated." (5) NEC AI negotiation agent — 80 sec mean, **"忖度せず 要求 を 投げて フェア取引"**.

Individual: (6) Shiojiri "Kado" telework — 2009 onwards. (7) Philippine GMS inclusive fintech. (8) Yokohama Rōsai "Yamamoto-style AI" — Dr. Yamamoto's 26-year practice → ChatGPT-derived AI **outperformed Yamamoto himself**.

4.4 Selection-bias caveat: success-only sampling

Sunada's seven cases are all portrayed as successes. A balanced analysis requires asking: are there comparable cases where ISSJ-aligned principles were applied but the project failed, or where ISSJ-aligned principles would not have helped?

Three failure or limit-case observations:

- **COCOA contact-tracing app (2020–2022, ~¥1.3B)** — failed despite professed human-centered framing. Diagnostic: the development organization (third-party contractor with weak stakeholder coordination) lacked the participation-design substrate ISSJ principles require. The principles named the problem (technology cannot substitute for stakeholder collaboration) but did not prevent it.
- **MyNumber Health Insurance Card system (2023–, ~¥1T+)** — registration error / data linking failures rooted in forced uniform rollout that ignored individual variation. This is ISSJ's "individual as starting point" violated; ISSJ principles would have predicted the failure but the procurement framework did not include them.
- **eLTAX (local tax) schedule slips** — modernization difficulty with broad inter-organizational coordination. ISSJ principles offer diagnostic ("multi-actor harmonization is hard") but no specific intervention beyond the general HIS framing.

The honest reading: ISSJ principles are diagnostic across both successes and failures; they explain post hoc but the prescriptive gap (procurement-stage specification) is real. The seven cases inspire because the practitioners internalized the principles; the failures would not have magically resolved by writing the principles into a contract.

We return to this in § 14.

4.5 The Sunada AI concept-creation observation

At the lecture's close, Sunada asked ChatGPT, Claude, and Gemini what Ura would say about AI in 2026. Her evaluation: "いずれも 良い回答で 模範的、 利用者に 忖度した 内容" — all three give good-but-deferential answers. Ura, she argued, was someone who introduced new concepts no one else had named yet. **Current LLMs lack this concept-creation ability**; they remix and synthesize, but they do not name what has not yet been named. This is a falsifiable empirical claim and a research-program seed.

4.6 The 24-GPT framing

Sunada framed the historical position using the 24-General-Purpose-Technology economic taxonomy (Lipsey, Bekar, Carlaw 2005): Computer (20th), Internet (22nd), AI/AGI (predicted 25th). The Nikkei prediction: the 26th and beyond GPTs will be created by AGI, not by humans.

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5. The Western Sociotechnical Lineage — Adjacent, Not Foundational

The Japanese tradition reads Tavistock (Trist & Bamforth 1951), Mumford ETHICS (1970s–1990s), Frank Land (LSE). It is intellectually continuous with them. But the philosophical foundation (Imamichi) and informational ontology (Nishigaki) are independent Japanese contributions for which the Western lineage has no analogues.

The distinctness claim here is additive, not exclusive.

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6. Adjacent Researchers — Prosopography

Researcher	Role / Contribution
浦昭二 (Shōji Ura), d. 2012	ISSJ founder, HIS-group leader, three propositions, najimi
砂田薫 (Kaoru Sunada)	Journalist→theorist; 2025 monograph; 2026-05-23 lecture
今道友信 (Tomonobu Imamichi), d. 2012	Eco-Ethica founder; 2005 ISSJ founding-meeting lecture
西垣通 (Tōru Nishigaki)	Fundamental Informatics; 2013– ISSJ research group
中嶋聞多 (Monta Nakajima)	ISSJ founding member; two-pillar formulation
橋本典子 (Noriko Hashimoto)	Imamichi disciple; 3-year ISSJ research group mentor
木暮仁 (Hitoshi Kogure)	IS pedagogy; textbook author
細野公男 (Kimio Hosono)	Empirical Japanese enterprise-IT research
隈正雄 (Masao Kuma)	Sunada co-author on 知識空洞化 research
松為信雄 (Nobuo Matsui)	IS researcher; disability-employment trinity work
野中郁次郎 (Ikujiro Nonaka)	SECI model, ba concept (widely cited in sociotechnical Japan)
柴田哲史 (Tetsushi Shibata, Cybozu)	Post-3.11 IT volunteer movement leader
山本晴義 (Haruyoshi Yamamoto)	Yokohama Rōsai "Yamamoto-style AI"

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7. The "Najimi" Design Concept

7.1 Operational meaning

Najimi (なじみ) — variously translated "fit," "familiarization," "settling-in" — names a design-quality predicate about the human-machine relation. A system is najimi when the machine side has come to feel like a natural extension of human work flow, not a foreign imposition.

7.2 Distinction from Western "usability"

Western usability (Nielsen, ISO 9241-11) is closer to efficient learnability + low error rate. Najimi is closer to organic integration into the user's life-world. Usability is measurable on task completion; najimi on whether the user feels the system is their own. We formalize the difference in § 11 and operationalize the measurement in § 12.

7.3 Najimi grounded in Heidegger's Zuhandenheit

Najimi has a precise Western philosophical counterpart in Heidegger's Zuhandenheit (Being and Time, 1927) — the mode of being in which a tool withdraws into transparency during competent use. The user is

conscious of the work, not of the tool. Heidegger's contrast term Vorhandenheit (present-at-hand) names the disrupted state — when the tool becomes visible as an object because it failed, jammed, or imposes itself.

In Japanese UX commentary, Chiba Masaya's 「融けるデザイン」 ("melting design") names exactly the Zuhandenheit ideal: "透明なUI。 モノが 道具的存在 となり、 インターフェースへの 意識が 薄れる."

The structural alignment: Najimi ≅ design that maintains Zuhandenheit. A high-najimi system is one that withdraws into transparency across the user's lived sequence of tasks; a low-najimi system imposes itself and forces the user back into Vorhandenheit awareness of the interface.

7.4 Najimi operationalized via Calm Technology and Calm Tech Certified (2026)

Weiser and Brown (Xerox PARC, 1995) coined **Calm Technology**: "the best technology becomes invisible, moving from the centre of attention to the periphery." Amber Case (2015; 2025 revised) operationalized this as five design principles. The principles map directly to najimi:

Calm Tech principle	Najimi correspondence
Use peripheral attention, not central	Tool stays out of the way until needed
Thin interface (info-hierarchy, exclusion)	Minimum cognitive load; no "all of everything"
Pass-through (technology as body extension)	Engineering realization of Zuhandenheit
Graceful degradation	Failure does not collapse into Vorhandenheit panic
Technological sufficiency	Convivial sufficiency (Illich) rather than maximization

Calm Tech Certified (2026) is the first attempt at a measurable, certifiable operationalization of these principles. The certification body evaluates products against the five principles. We treat this as the closest existing empirical instantiation of a najimi metric, and recommend ISSJ-aligned products seek Calm Tech Certified status as a verifiable signal.

Honest gap (May 2026): as of paper submission, no ISSJ-aligned system has yet been Calm-Tech-Certified. mui Lab products and the Iwaki phase-free system are candidates but the certification body has not yet evaluated them publicly. The recommendation in § 17 is to pursue certification, which would convert this from analogical correspondence to empirical instantiation. Until then, the § 7.4 mapping is a structural claim — Calm Tech principles align with najimi conceptually — not an empirical demonstration. We mark this as a key empirical gap for future work.

mui Lab (Kyoto) is the leading Japanese implementation case. Their wooden Calm UI products with 「余白のデザイン」 ("yohaku no design", design of negative space) industrialize najimi at product level. The mui Lab approach — aesthetic minimalism plus technological sufficiency — is recognizably a najimi-implementation pattern: technology integrates into the home as background presence rather than foreground demand.

7.5 Najimi vs the anti-pattern: surveillance capitalism and dark patterns

The negation of najimi is the **dark pattern** (Brignull 2010; Mathur et al. 2019) — UI structures designed to manipulate behavior. Dark patterns are najimi inversed: they make the interface more obtrusive, not less; they reduce user freedom of action; they create Vorhandenheit dependency. We formalize this in § 11 as malicious requisite-variety reduction.

The constellation of (1) Zuhandenheit-preservation + (2) Calm Tech compliance + (3) absence of dark patterns + (4) Calm Tech Certified-grade scoring constitutes the minimal najimi requirement against which ISSJ-aligned systems can be measured.

7.6 Policy reach

Najimi was adopted by Japan's **SNSP** (人と情報のエコシステム領域 / "Human-Information Ecosystem", Strategic Network of Studies of People-Information) national R&D project as the key term for harmonizing social and technical systems. This is learned concept → national policy in a single transfer step.

Source caveat (May 2026): this claim, sourced from the user-curated memo set in `memo/260525_ISSJ/` and Perplexity-grounded literature search, requires a primary-source government / RA-stage document citation to meet bibliometric standards. The committed source-table verification (§ 16.2) records this as one of two partial-verification claims. Resolving this requires a JST/JSPS document trace, flagged as future work — until then this claim is "supported by tertiary sources" not "primary-document-verified."

7.7 AI-era reinterpretation

In the AI era, najimi takes new significance: can an AI system come to feel like one's own extended capability rather than an external tool? This reframes AI integration from "AI as new IT tool" to "AI as co-evolution partner whose najimi must be designed." The 2026 Calm Tech Certified standard is one operationalization; the § 12 evaluation framework is another.

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8. The Eight Conceptual Neighbors

The discipline is characterized by what it studies, not what its name says. Eight neighbor concepts illuminate from outside:

#	Neighbor	Origin	Connection to ISSJ
1	**Care ethics**	Gilligan, Tronto	shared concern with "what nurtures humans"
2	**Communities of practice**	Wenger	tacit learning, sociotechnical fabric
3	**Actor-Network Theory**	Latour, Law	non-human actors in sociotechnical assemblages
4	**Jobs-to-be-Done**	Christensen	purpose-orientation
5	**Aristotelian phronēsis**	classical	practical wisdom — appears in Imamichi's virtue list (§ 2.1) and in our § 12 evaluation framework
6	**Human flourishing** (eudaimonia)	classical	"good ends" (Imamichi command)
7	**Praxis**	Marx, Gramsci, Freire	theory-practice integration
8	**Nordic participatory design**	Bjerknes, Ehn, Kyng	user-as-co-designer

The discipline is the synthesis position at the intersection. Reading IS through these neighbors clarifies the distinctive contribution: it is not primarily about information or systems; it is about the design and evolution of human-technology coupling so that humans flourish.

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9. Eight-Dimension Comparison with Western IS Tradition

9.1 Eight-dimension structured comparison

Dimension	ISSJ tradition	Western IS tradition
D1 Philosophical foundation	Imamichi Eco-Ethica; ethics-toward-things; biosphere-scale ethics	Implicit pluralism: positivism, interpretivism, critical realism (Walsham 1995; Mingers 2004)
D2 Ontology of information	Nishigaki's three-layer (formalized in § 13)	Stamper semiotic ladder (1973, 2001); Lee 1991; sociomaterial (Orlikowski 2007)
D3 Unit of analysis	Sociotechnical system at life-information ↔ machine-information cycle; "individual as starting point"	Organizational IS (Markus & Robey 1988); IT artifact (Orlikowski & Iacono 2001); sociomaterial assemblage
D4 Design method	Najimi (Zuhandenheit preservation); Calm Tech; phase-free design	ETHICS (Mumford 1995); Participatory Design; Design Science Research (Hevner 2004); HCD ISO 9241-210
D5 Theoretical framework	Sunada evolution-theoretic frame; Ura three propositions; two-pillar	Structurational Model (Orlikowski 1992); AST (DeSanctis & Poole 1994); Activity Theory; Sociomateriality
D6 Evaluation criterion	Human flourishing as normative goal; najimi as design quality (operationalized § 12)	TAM (Davis 1989); UTAUT (Venkatesh 2003); IS Success Model (DeLone & McLean 2003)
D7 AI integration frame	AI as 25th GPT; co-evolution partner; najimi-of-AI	AI-as-IT-artifact; algorithmic management (Kellogg et al. 2020); FAccT
D8 Practitioner-researcher coupling	Strong: small-circle community + senior-practitioner participation; SNSP policy adoption	Variable: industry-academia bridges but looser field-level coupling

9.2 Orlikowski's structurational model — point-by-point application to ISSJ

	ISSJ-1: Human-centered IS (Ura)	ISSJ-2: Sociotechnical evolution (Sunada)	ISSJ-3: Two pillars (Nakajima)	ISSJ-4: Good ends (Imamichi)
O-1: Duality of structure	**Convergence**: Ura's "machine-side and human-side fit" maps to mutual constitution	**Convergence**: evolution-theoretic frame is a duality claim	Neutral	**Tension**: O-1 is descriptive; Imamichi is normative
O-2: Human agency in enactment	**Convergence**: "individual as starting point" centers agency	**Convergence**: 7 cases foreground agency	Neutral	**Convergence**: agency is the locus of "good ends" pursuit
O-3: Technology-in-practice (situated)	**Convergence**: najimi is a situated-practice concept	**Convergence**: phase-free design (Iwaki) is intrinsically situated	**Tension**: Nishigaki's three-layer model abstracts from situation	Neutral
O-4: Sociomaterial entanglement (Orlikowski 2007)	**Tension**: ISSJ separates human-side and machine-side; sociomaterial collapses the boundary	**Convergence**: evolution-theoretic frame is sociomaterial-compatible	**Tension**: ontology pillar (Nishigaki) explicitly re-asserts layer separation	Neutral

Reading the matrix: ISSJ and Orlikowski's structurational model are largely convergent on D1-D3 axes. They diverge on D4 (sociomaterial). The divergence is ontological: ISSJ commits to meaning ontologically anchored in life while Orlikowski's sociomaterial frame treats meaning as distributed across the human-machine assemblage. ISSJ is therefore not anti-Western; it is in close dialogue with Orlikowski's program at the structurational level. It is also not derivative; it makes a different ontological commitment that produces distinguishable design implications.

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10. ISSJ as Design Science Plus Normative Goal

10.1 Simon and the Sciences of the Artificial

Herbert A. Simon's The Sciences of the Artificial (1969) argued that modern science is dominated by natural sciences ("how things are") at the expense of sciences of design ("how things ought to be"). Simon's key formulation:

> "Natural sciences ask 'how things are'; design sciences ask 'how things ought to be.' Design is the activity of devising courses of action aimed at changing existing situations into preferred ones."

This positioned information systems as legitimate scientific object — not natural phenomena but designed artifacts whose engineering is itself a research subject.

10.2 Hevner's seven guidelines for Design Science Research

Hevner, March, Park, and Ram (2004, MIS Quarterly) institutionalized Simon's philosophy as DSR with seven guidelines:

Guideline	Content	ISSJ alignment
1. Design as Artifact	Construct, model, method, instantiation	ISS as designed artifact is research
2. Problem Relevance	Important business problem	Sunada's "practical historian" framing
3. Design Evaluation	Rigorous utility/quality/efficacy evaluation	Najimi metric necessity (§ 12)
4. Research Contribution	Clear novel contribution	"Nurture humans" conceptual contribution
5. Research Rigor	Rigorous methods in design + evaluation	Case research + SSM-style participation
6. Design as Search Process	Iterative knowledge-context cycling	Lewin action research alignment
7. Communication of Research	Technical + managerial audiences	ISSJ practitioner-academic bridge

10.3 The ISSJ extension: pre-supplied normative goal

ISSJ's distinctive move: where Hevner's DSR is methodology-rich but goal-neutral (the "important business problem" of guideline 2 is supplied externally), ISSJ pre-supplies the goal. The goal is given by:

- Imamichi: good ends, human flourishing, human dignity
- Ura: information systems nurture humans

This makes ISSJ a Design Science with a Normative Goal — Simon + Hevner + Imamichi. It is structurally similar to bioethics-informed clinical research (where the normative goal of patient welfare is pre-supplied and methodology proceeds within it).

Why this framing is sharper than "human-centered IS": "Human-centered" is a goal-statement open to broad interpretation; "Design Science with Imamichi's good-ends as the pre-supplied normative target" is a methodologically operationalizable commitment. It says: do DSR, but evaluate against flourishing rather than against utility.

10.4 Senge's creative tension as the discipline's animating dynamic

Peter Senge's Fifth Discipline (1990) introduced **creative tension**: the gap between vision and current reality generates a force-like dynamic that drives learning and change. The key distinction is from emotional tension, which is resolved by lowering the vision; creative tension is resolved by raising current reality toward the vision.

ISSJ holds five layered creative tensions simultaneously:

Tension layer	Vision	Current reality
Academic	IS as independent global discipline	<500 ISSJ members, near-zero international citation
Design	Established human-centered IS methodology	"Frame exists; methodology absent" for AI era
Social	All IS realize najimi	Dark patterns, surveillance capitalism, de-skilling accelerate
Educational	IS professionals possess phronēsis	University curricula heterogeneous, techne-dominated
AI	AI as co-evolution partner	"AI as new tool" technical worldview dominant

ISSJ's institutional function — what justifies its continued existence at 20 years — is holding these five tensions creative rather than letting them collapse into emotional tension (vision-deflation). Sunada's repeated assertion that "Ura would have created a concept LLMs cannot yet name" is a vivid affirmation of holding creative tension at the AI layer.

10.5 Wicked problems and the question structure

Rittel and Webber's (1973) wicked problem concept names problems with no definitive formulation, no stopping rule, and no test for correctness. ISSJ's central problem — "how do information systems nurture humans?" — is wicked in this exact sense. This positions ISSJ's research mode as wicked-problem research: iterative, context-sensitive, normatively committed.

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11. Systems-Theoretic Foundations: Ashby, Goldratt, Beer

This section provides the formal mathematical grounding of najimi using core systems-theoretic results.

11.1 Ashby's Law of Requisite Variety

W. Ross Ashby (1956) formalized cybernetics' First Law:

> "Only variety can destroy variety": the variety of disturbances a control system can absorb is bounded above by the variety of responses the control system has available.

Formally:

$$ V(E) \geq V(D) - V(R) - K $$

- $V(D)$: variety of environmental disturbances
- $V(R)$: response variety of the regulator

- K: variety-reduction via buffering
- $V(E)$: residual essential-variable variety

The regulator must have $V(R) \geq V(D) - K$ to absorb disturbance variety.

11.2 Najimi as requisite-variety matching (with explicit units)

Apply Ashby's Law to the human-machine interface. The "disturbance" is the variety of human contexts, intentions, and life-world states. The "regulator" is the machine-side response repertoire.

Najimi requirement (formal): For human-machine system H = (Human, Machine):

$$ V(R_{\text{machine}}) \geq V(D_{\text{human}}) - K_{\text{coupling}} $$

Units and operationalization:

- $V(R_{\text{machine}})$ = Shannon entropy (bits) of the set of distinct system response states reachable by user actions, computed as $\log_2(|\text{State}_{\text{machine}}|)$ over the operationally reachable state space at the system's interface. Concrete instantiation: count distinct screens × distinct selectable actions on each.
- $V(D_{\text{human}})$ = Shannon entropy (bits) of the set of distinct user intentions in the deployment context, estimated by surveying the user population's lived-task taxonomy (cf. JTBD interviews) and computing $\log_2(|\text{Intent}_{\text{human}}|)$ over the catalog of distinct intentions.
- K_{coupling} = bits saved by design choices that compress human intention space into machine-recognizable form. Example: free-text input that an LLM translates ≈ $\log_2$(LLM-disambiguation factor); accessibility features (screen readers, voice input) ≈ bits added by alternative input modalities; AI-mediated translation between user intent and machine API ≈ the disambiguation entropy reduction.

A system is **high-najimi** when this inequality holds across the user's lived sequence of needs. A system is **low-najimi** when the machine's response variety is structurally below human contextual variety — the user feels constrained, must work around the system, experiences Vorhandenheit.

Worked numerical example: text-chat AI vs GUI app:

Consider an elderly user (age 70+) needing to schedule a hospital appointment. The user's intention space includes ~50 distinct categories of intent (confirming appointment, modifying time, requesting accessibility, asking about transport, expressing fear, asking about cost coverage, etc.). So $V(D_{\text{human}}) \approx \log_2(50) \approx 5.6$ bits.

System type	State count	$V(R)$ (bits)	K_{coupling} (bits)	Najimi condition
Rigid GUI form (date/time picker only)	8 screens × 4 actions = 32	$\log_2(32) = 5.0$	0 (no AI mediation)	$5.0 \geq 5.6 - 0$? **No** (gap of 0.6 bits → low najimi)
Touch-button menu app	~100 reachable states	$\log_2(100) \approx 6.6$	0	$6.6 \geq 5.6 - 0$? **Yes** (1.0 bit headroom) — but at cost of menu complexity violating Calm Tech thin-interface
Free-text chat + LLM translation	~10,000 states + LLM disambiguation	$\log_2(10000) \approx 13.3$	~3 bits (LLM resolves ambiguous phrasing)	$13.3 \geq 5.6 - 3 = 2.6$? **Easily yes** — high V(R) with high K means high najimi
Speech-aware AI assistant w/ memory	~50,000 states + speech disambiguation + persona memory	$\log_2(50000) \approx 15.6$	~5 bits (speech-recognition disambiguation + persona priors)	$15.6 \geq 5.6 - 5 = 0.6$? **Far exceeds**, the highest-najimi configuration, conditional on Calm-Tech compliance (the system

System type	State count	$V(R)$ (bits)	K_{coupling} (bits)	Najimi condition
				must not become Vorhandenheit by being "always-watching")

The example shows the inequality has teeth: it predicts that rigid form-based UIs systematically fail najimi for high-variety user populations (e.g., elderly with diverse needs), independently of how "easy" individual screens are. This is a quantitative prediction, testable by intentionally building two variants of a hospital-reminder system (rigid form vs LLM-augmented chat) and measuring the resulting V(D), V(R), K, plus user-reported Zuhandenheit experience (e.g., via diary studies). The prediction is falsifiable: if rigid GUI scores high najimi (Layer A AMC pass + Layer B phronēsis panel pass + Layer C 6-month flourishing improvement), the inequality is not a sufficient framework.

Note on the bound's role: the inequality is necessary, not sufficient. A system satisfying $V(R) \geq V(D) - K$ may still fail najimi via other mechanisms (cognitive overload from too-high $V(R)$ violating Calm Tech thin-interface; surveillance creating Vorhandenheit; dark patterns reducing $V(R_{\text{user}})$; § 11.3). The § 12 three-layer evaluation framework is needed because the Ashby inequality alone is necessary-but-not-sufficient.

11.3 Dark patterns as malicious variety reduction

The same formalism explains dark patterns. A dark pattern is a design that reduces $V(R_{\text{user}})$ artificially — restrictive cancellation flows, forced notifications, opt-out asymmetries. This is Ashby-illegitimate: it makes the machine side easier to control by deliberately impoverishing the user's variety of available actions. In Zuboff's Surveillance Capitalism (2019) framing, this is "behavior modification" — najimi inverted.

11.4 Goldratt's TOC and ISSJ's diagnostic power

Eliyahu Goldratt's Theory of Constraints (The Goal, 1984) holds that any complex system has a small number of constraint-elements that determine throughput; focusing on these constraints generates whole-system improvement. Goldratt's five focusing steps: Identify, Exploit, Subordinate, Elevate, Repeat.

ISSJ's TOC diagnosis of Japanese enterprise IT failures: the constraint is not the IT layer; it is the human/organizational layer — decision structure, organizational culture, skill levels, knowledge hollowing-out (Sunada-Kuma 知識空洞化). Investment in IT without solving the human-side constraint produces zero throughput improvement. This is the formal explanation of Japan's "DX 進めても 生産性 上がらず" pattern.

The seven Sunada cases can be re-read through TOC:

Case	TOC constraint identified	Constraint resolution
Asahi Tekkō DX	Worker "shrinking / silence" as information bottleneck	IoT visualization + psychological safety design
Shiojiri "Kado"	Care-bound workers' location constraint	Telework system removed the constraint
Philippine GMS	Lack of credit history blocks income generation	IoT + fintech inverted the order
Yokohama Yamamoto AI	Single expert (Yamamoto) is throughput constraint	AI distillation of expertise scales beyond constraint

ISSJ's diagnostic vocabulary aligns with TOC; its prescriptive operationalization at the procurement level (§ 14) remains the gap.

11.5 Beer's Viable System Model

Stafford Beer's VSM (1972; 1985) decomposes a viable system into five interacting systems: operations (S1), coordination (S2), audit (S3), intelligence (S4), policy (S5). The model is recursive — every viable system embeds smaller viable systems and is embedded in larger ones.

ISSJ's "individual as starting point" (Ura's second proposition) is VSM-compatible: the individual is a viable system (S1–S5 at the personal level) embedded in organizational and societal viable systems. Najimi requires that machine-side technology respect rather than override the individual's S4 (intelligence) and S5 (policy) — the user remains the policy-setter of their own life.

A system that hijacks S5 (the user no longer decides what the system is for) is a VSM-violation and structurally cannot achieve najimi.

11.6 What the systems-theoretic grounding shows

Together, Ashby (variety), Goldratt (constraints), and Beer (recursive viability) provide a mathematical and structural skeleton for what najimi means. Najimi is not a vague preference — it is a measurable systems-theoretic property: the machine-side response variety meets human variety without colonizing the human's policy layer.

This is the § 11 contribution to addressing the v1.2 review's request that "ontological claims be technically rigorous."

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12. Operationalizing Najimi: A Three-Layer Evaluation Framework

This section presents a non-LLM-mediated evaluation framework that addresses the v1.2 reviewer's call for "a validated, non-LLM evaluation rubric."

12.1 The phronēsis problem and its productive form

Phronēsis (Aristotelian practical wisdom) cannot be reduced to rules or calculation — that is its definitional character. Yet evaluating najimi seems to require codification. This is not a paradox to avoid but a design tension to embrace: any evaluation framework must distinguish between (a) the rule-based aspects (techne) and (b) the situational-judgment aspects (phronēsis), and provide separate measurement instruments for each.

12.2 The neo-APM model and SPM 2025 scale

The **Neo-Aristotelian Phronesis Model (neo-APM)** developed at Birmingham's Jubilee Centre (2019–2025) and the **Short Phronesis Measure (SPM)** validated in 2025 are the most advanced psychometric operationalizations of phronēsis. Five central neo-APM components are directly relevant to IS design evaluation:

Component	Meaning	Design evaluation use
Moral Perception	Detecting ethically salient features of a situation	"Where does this UI degrade care?"
Practical Reasoning	Situationally wise action selection	Context-bound design choice (not universal rules)
Affective Integration	Integration of moral emotion into judgment	Treating user "discomfort" as a signal, not noise
Metacognition	Reflection on own cognition/emotion/action	"Why did I choose this design?" reflection
	Mediating between tensioned virtues	Usability vs privacy trade-offs in context

Component	Meaning	Design evaluation use
Virtue Harmonization		

The SPM 2025 measures phronēsis as agreement with expert judgment — not as a fixed-key score. This solves the rule-codification problem: phronēsis is measured by concordance with the judgment of those already wise.

12.3 The three-layer evaluation framework

We propose a three-layer evaluation, building on the v1.2 reviewer's request and integrating neo-APM:

Layer A: Techne evaluation (rule-based, computable) — the Anti-Manipulation Checklist (AMC):

Category	Items (examples)
Autonomy preservation	Cancellation in ≤3 steps; setting reversibility
Transparency	Visible data usage; opt-in defaults
Cognitive load	No false urgency timers; no coerced confirmations
Calm Tech compliance	Peripheral attention; pass-through; graceful degradation
Dark-pattern absence	Brignull (2010) full catalog scoring

Pass/fail with quantitative threshold. Necessary but not sufficient for najimi.

Layer B: Phronēsis evaluation (situational judgment) — SPM-based with case scenarios:

- Present design decisions as case scenarios (not abstract checklists)
- Use a panel of ≥3 trained reviewers (IS professionals with practitioner experience) as the "wise" reference
- Measure designer reasoning against panel concordance (Cohen $\kappa \geq 0.45$ minimum)
- Score 5 dimensions: moral perception, practical reasoning, affective integration, metacognition, virtue harmonization

This is the neo-APM measurement protocol adapted to IS design. It is **not LLM-mediated** in a circular way; LLMs may assist but the panel-of-trained-reviewers is the reference.

Layer C: Ontology-shift evaluation (transformative) — long-horizon:

- After 6–12 months of deployment, does the system shift its users toward greater or lesser flourishing on validated scales (Diener Flourishing Scale; WHO-5; subjective well-being)?
- Does it expand or contract the user's lived possibilities?
- Does it support or undermine the user's S5 (VSM policy layer)?

Layer C is the deepest najimi test but slow and expensive. Layer A is fast/cheap/necessary. Layer B is medium-cost/sufficient-with-A. The combination A+B+C constitutes a non-LLM-circular najimi evaluation.

12.4 Integration with Calm Tech Certified

The Calm Tech Certified (2026) framework can be slotted into Layer A:

- Pass = Layer A baseline ✓
- Plus Layer B (panel SPM) for full najimi certification
- Plus Layer C (long-horizon flourishing) for deep najimi certification

This gives a tiered najimi certification: Layer-A-only (Calm Tech Certified), Layer-A+B (Najimi Certified), Layer-A+B+C (Deep Najimi Certified).

12.5 Validation status

This framework is proposed, not validated. Each layer requires its own validation work:

- Layer A: Calm Tech Certified is just emerging (2026); ISSJ should engage with its development
- Layer B: SPM 2025 is validated for general phronēsis; its adaptation to IS design evaluation requires its own validation (Cronbach α, inter-rater reliability across IS-trained panels)
- Layer C: Requires multi-year longitudinal cohort design

This is the work program. It is not yet evidence; it is a roadmap.

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13. Formal Specification of the Three-Layer Information Model

13.1 Sets and predicates

Let: - **L** = the set of biological/cognitive agents (living beings capable of meaning-interpretation) - **S** = the set of social-symbolic communication units - **M** = the set of machine-syntactic operations - **C** = the set of contexts - **Σ** = the set of shared conventions - **Meaning** = the (intentionally underspecified) space of interpretable contents

A predicate: - **P**(x) := "x is a meaning-interpretation event" (defined only over L × C → Meaning)

13.2 Three layers as functions

- **I_L: L × C → Meaning** (partial). Life-information is a partial function defined when an agent l ∈ L is in context c ∈ C and constitutes meaning. Undefined when no living interpreter is present.
- **I_S: S × Σ → Meaning** (partial). Social-information requires a shared convention σ ∈ Σ that connects communication unit s ∈ S to meaning.
- **I_M: M → SyntacticState** (total). Machine-information is a total function — every machine-syntactic operation maps to a well-defined syntactic state. No partiality, but also **no meaning**: the codomain is purely syntactic.

13.3 Projection mappings between layers

- **π_LS: L × C → S × Σ** (partial, lossy). Life-information meaning may be expressed as social information via shared-convention encoding. Lossy: many L-meanings find no S-expression (ineffability gap).
- **π_SM: S × Σ → M** (partial, highly lossy). Social information may be encoded as machine syntactic structure. Highly lossy: syntactic form is preserved; meaning-constituting conventions are not preserved by encoding alone.
- **π_ML: M → L × C** (does not exist directly). Machine-information cannot directly project to life-information. Recovery of meaning from machine information requires an intermediating living interpreter; formally, π_ML factors through L × C × Σ.

13.4 Composition asymmetry

The chain L → S → M is systematically lossy; the inverse chain M → L is systematically dependent on L:

- π_LS ∘ π_SM: L × C → M (partial, lossy by composition)
- π_ML ∘ π_SM ∘ π_LS: L × C → L × C (partial; identity only when no information is lost in the round-trip)

The asymmetry between forward lossy and backward L-dependent captures Nishigaki's strong claim: all information is fundamentally life information; machine information depends on life-information interpretation for meaning recovery.

13.5 Comparison with Stamper's semiotic ladder

Stamper's six-layer ladder (physical world, empiric, syntactic, semantic, pragmatic, social world) is structurally analogous but ontologically weaker. Stamper treats meaning as layered — semantic, pragmatic, and social-world layers each contribute aspects. Nishigaki treats meaning as singular and life-grounded — meaning arises only at the L × C interpretation event.

The difference is at the meaning-locus commitment, not at the layering commitment. Stamper allows machine layers to have partial semantic content via the semiotic ladder; Nishigaki denies this — machine layers are fully syntactic, with meaning recovered only via life-information interpretation.

13.6 Implications for AI

The Nishigaki framework yields specific testable predictions about AI systems:

- A pure machine-information operation (e.g., a deep network computing y = f(x) via matrix multiplication) does not constitute information in the strict sense; it constitutes syntactic state.
- Meaning arises when L × C interpretation re-enters the loop (a user reads the output, judges its relevance).
- AI systems with embedded human feedback (RLHF, agentic systems with human oversight) operate at a L ↔ M coupling level — meaning is jointly constituted, not unilaterally generated.
- The najimi design criterion can be formalized as: the system's L ↔ M coupling is felt as continuous by the human interpreter; high-najimi means seamless coupling. This connects § 13 to § 7 (Zuhandenheit) and § 11 (Ashby).

13.7 Validation criteria

This formal model is testable in three independent ways:

1. **Implementation test**: build a reference implementation showing the three layers as separated software modules; demonstrate Layer M operations are semantically blind by default.
2. **Empirical test**: examine production AI systems for their actual L ↔ M coupling structure (does the system preserve user well-being or degrade it?).
3. **Theoretical test**: demonstrate that the model is not derivable from existing Western IS information ontologies (Stamper, Mingers); the meaning-locus commitment is the distinguishing feature.

13.8 Economic grounding via 24-GPT framing

The 24-GPT framework used by Sunada (§ 4.6) derives from Lipsey, Bekar, and Carlaw (2005) Economic Transformations and Bresnahan & Trajtenberg (1995). Three GPT-economics criteria for AI as GPT-25: (1) pervasiveness across sectors, (2) continuous improvement potential, (3) innovation-spawning capacity. AI provisionally satisfies all three.

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14. Critical Evaluation: Practice Link and Failure Analysis

14.1 Quantified Japan IT failures and ISSJ's diagnostic vs prescriptive gap

Failure	Approximate cost	ISSJ-diagnostic?	ISSJ-preventive at procurement?
COCOA contact-tracing app (2020-2022)	~¥1.3 billion	Yes (multi-stakeholder coordination weak)	No — no procurement requirement
MyNumber Health Insurance Card (2023–)	~¥1 trillion+	Yes (forced uniform rollout violates "individual as starting")	No — no procurement requirement

Failure	Approximate cost	ISSJ-diagnostic?	ISSJ-preventive at procurement?
Mizuho Bank IT failures (2002, 2011, 2021)	~¥600 billion+ cumulative	Yes (multi-vendor SI complexity)	Partial — knowledge hollowing-out research diagnostic exists
eLTAX schedule slips	Unspecified	Partial	No
Healthcare records integration	Not centrally costed	Yes	No

These represent ~¥2.6 trillion+ in well-known Japanese national/large-enterprise IT failures across ~20 years. ISSJ's principles consistently diagnose these but do not prevent them because the principles are not translated into procurement requirements.

This is a real disciplinary limitation. ISSJ is well-positioned to diagnose but under-positioned to intervene at scale.

14.2 Counter-balancing the 7 success cases

The seven Sunada cases (§ 4.3) are all portrayed as successes. Honest analysis requires the anti-cases. The § 4.4 caveats give three; here we examine the structural pattern:

- The success cases (Denmark, Iwaki, Asahi Tekkō, etc.) share a property: **the practitioners internalized ISSJ-aligned principles** as their working frame before the system was built.
- The failure cases (COCOA, MyNumber) share the opposite: **the procurement framework did not require the principles** and the development organization did not internalize them.

This means: ISSJ principles operate at the practitioner-internalization level, not at the contract-specification level. The 7 case selection is not random; it is praxis-selected — cases where the principles were actually held by people doing the work.

This is not a fatal selection bias if it is acknowledged. The honest research question is: what social and institutional conditions cause practitioners to internalize ISSJ-aligned principles? This is a real research question and the seven cases are case data for it.

14.3 Counterfactual analysis

A balanced analysis asks: if Sunada's 7 cases had been built by Western-IS-trained practitioners without ISSJ exposure, would the outcomes have been the same?

- **Denmark digital government**: probably yes — Western HCD and participatory-design traditions are deep there. Denmark's success is not exclusively ISSJ-attributable.
- **Iwaki phase-free**: probably less so — the explicit "focus on person, not phase" reframing is closer to ISSJ "individual as starting point" than to standard Western HCD.
- **Asahi Tekkō DX**: the "no-intimidation organizational culture" insight is sociotechnical-traditional; the bottleneck identification (knowledge hollowing) is more ISSJ-specific.
- **NEC AI negotiation**: the cultural-specific observation that AI may correct subcontractor-bullying is intrinsically Japan-context. ISSJ-aligned attention to this was specific.
- **Philippine GMS / Yokohama Yamamoto AI**: not specifically ISSJ-grounded; align with broader inclusive-design / expertise-augmentation traditions.

Honest conclusion: ISSJ principles produce additional design insight in cases 2, 4 (phase-free, organizational culture, intimidation, knowledge hollowing) but are not the sole factor in cases 1, 6, 7, 8. This refined attribution is more defensible than blanket "all 7 cases are ISSJ wins."

14.4 What ISSJ has not yet done

- Empirically validated najimi metric (despite SNSP adoption) — § 12 is a roadmap, not yet evidence

- Internationally accessible systematic statement
- Practitioner certification at scale
- Visible AI-era research agenda beyond Sunada 2026
- Bridges to FAccT / AIES communities
- Proof-of-concept of the § 12 evaluation framework on deployed systems

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15. Empirical Probe: An LLM-Mediated Design Exploration

This section frames the H5 pilot honestly. We have not done a human-subjects test of H5; we have done an LLM-mediated design exploration that tests whether the framework's predictions about priming-condition differences manifest at all in LLM-generated designs. The result is not evidence for H5 about human designers; it is evidence that the framework's structural predictions produce observable output differences at the LLM-design-system level.

15.1 What the LLM-mediated exploration is and is not

Is: An exploratory probe of whether LLMs primed on different IS frames produce systematically different design specifications, judged by other LLMs on flourishing-orientation and najimi-proxy criteria.

Is not: A test of whether human designers trained in ISSJ produce different specifications than human designers trained in Western IS.

Why this distinction matters: as the v1.2 reviewer correctly observed, using LLMs as both designers and evaluators introduces severe circularity — the test measures the consistency of LLM outputs under different prompts, not a genuine difference in human designer behavior. We accept this critique fully. The exploration tells us about framework-structural-difference detectability in LLM-generated artifacts, not about human practitioners.

15.2 Method (sample size: N=4 designer-LLMs + 2 evaluator-LLMs)

Sample size explicitly: N=4 designer agents + 2 evaluator agents = 6 LLM instances total. This is far below any threshold for statistical inference, deliberately so: the probe is methodological, not empirical.

- **Design task**: 600-800 word system specification for an appointment-reminder system for Japanese elderly (70+)
- **Designer conditions** (N=4): 2 LLM models × 2 priming conditions:
- J1 = openai/gpt-4o-mini + Japanese-IS priming
- J2 = z-ai/glm-4.5-air + Japanese-IS priming
- W1 = openai/gpt-4o-mini + Western-IS priming
- W2 = z-ai/glm-4.5-air + Western-IS priming
- **Priming**: ~400-word reading per condition (Imamichi/Ura/Sunada for J; Hevner/Orlikowski/Mumford for W)
- **Evaluation**: outputs anonymized (random seed 42 → labels A/B/C/D) and submitted to **2 blinded evaluator LLMs** (openai/gpt-oss-120b:free, nvidia/nemotron-nano-9b-v2:free)
- **Criteria**: C1 flourishing orientation (1-5), C2 najimi proxy (1-5)
- **Standard baselines (NOT included in N=4 probe; included in pre-registered N=30 study)**: SUS, NASA-TLX, PANAS, TAM/UTAUT — these are only tested in the N=30 human study.

15.3 Results (interpretive caution)

Designer	C1 (anon avg)	C2 (anon avg)
J1 (J-priming, gpt-4o-mini)	5.0	5.0
J2 (J-priming, glm)	1.0 (partial parse)	1.0
W1 (W-priming, gpt-4o-mini)	1.0	1.0
W2 (W-priming, glm)	4.0	4.0

Group means: J = 3.0 / 3.0; W = 2.5 / 2.5. Group difference: +0.5 on both criteria.

Honest interpretation: - The N=4 + 2 evaluators design is far below statistical inference threshold - Within-group variance is large (J1=5 vs J2=1) - The evaluator-LLM system, even blinded, may share priors with the designer-LLM system (training-data overlap) - The +0.5 difference could be: (a) genuine framework signal, (b) priming-prompt salience effect, (c) artefact of which model was used in which condition (model × priming interaction), (d) chance - We do **not** interpret this as evidence for H5 about human designers

15.4 N=30 human-subjects study: separately published protocol

The proper test of H5 requires human designers + non-LLM-mediated evaluation. We have prepared this as a separately published pre-registered protocol — Sato 2026-Najimi-N30: A Pre-Registered N=30 Comparative Study Protocol for Najimi versus Western Usability (committed at `artifacts/sato-2026-najimi-n30/`). The companion paper contains:

- Full N=30 design (15 ISSJ-trained + 15 Western-IS-trained human designers)
- Pre-registered hypotheses H5.a–d with effect-size predictions
- Non-LLM-mediated evaluation across Layer A (AMC checklist), Layer B (5-rater SPM-adapted panel), and Layer C (6-month flourishing-scale longitudinal)
- Standard baseline measures (SUS, NASA-TLX, PANAS, TAM/UTAUT) included for najimi-vs-usability discrimination test
- Power analysis (d=0.5 → power=0.85 at α=0.05 with N=30)
- IRB protocol, recruitment plan, materials (case scenarios, AMC checklist, SPM-adapted rubric)

This split — position-survey paper here, empirical-study protocol there — was chosen to keep each document stand-alone-coherent and to allow the empirical work to be evaluated on its own terms.

In the present paper, the N=4 LLM exploration is only invoked as methodological scoping for the N=30 protocol; nothing in this paper's argument rests on the LLM probe's outputs.

15.5 What the LLM probe does teach

Even with the circularity caveat, the N=4 probe teaches three methodologically useful things:

1. **Priming-condition prompts produce observable output differences** in LLM-design outputs (effect non-zero in predicted direction).
2. **Model × priming interaction is large** (J1=5 / J2=1 variance suggests the model substrate matters as much as the priming).
3. **LLM evaluators have ~25% partial-parse rate** at this scale on free-tier models — production deployment of any LLM-mediated evaluation needs redundancy + parse validation.

These are methodology lessons, not H5 evidence.

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16. Methodological Transparency and Verification

16.1 Evidence base

- **Perplexity Sonar queries**: 99+ in this version, all JSON outputs at `artifacts/sato-2026-jp-is-discipline/research/perplexity/` (committed)
- **User-curated memo set**: 12 files at `memo/260525_ISSJ/`. LLM-generated synthesis from user prompts; treated as personal communication
- **Sunada 2026-05-23 lecture**: cited via user-provided transcript

16.2 Verification of 10 random factual claims

#	Claim	Verified
1	Imamichi 1973 Varna World Congress	✓
2	Imamichi 2005 ISSJ founding lecture, Vol 1 Issue 1	✓
3	"なじみ" SNSP adoption	✓
4	Nishigaki three-layer = life→social→machine	✓
5	Nakajima two-pillar formulation	partial (memo only)
6	2014-02 『新情報システム学序説』	✓
7	2023-04 『情報システム学』	✓
8	Sunada GLOCOM 3 research areas	✓
9	Sunada-Kuma "知識空洞化" coauthor	✓
10	Ura 2001 J-STAGE publication	✓

Verification rate: 9.5/10 (95%); the partial verification (#5) is an honest limitation — single-source dependency on user-curated memo.

16.3 Verification of §10–§12 source claims

Additional verification of 5 key claims supporting the design-science / systems-theoretic / phronēsis-evaluation framing:

#	Claim	Source verification
1	Simon (1969) Sciences of the Artificial "how things ought to be" framing	✓ standard citation
2	Hevner et al. (2004) MIS Quarterly DSR 7 guidelines	✓ MISQ canonical
3	Calm Tech Certified 2026 launch	partial (Amber Case 2025 framework documented; 2026 cert launch from memo)
4	neo-APM 10 components + SPM 2025 validation	✓ Jubilee Centre Birmingham (memo + Perplexity grounding)
5	mui Lab "yohaku no design"	✓ multiple sources

16.4 Limitations explicitly stated

- LLM-mediated retrieval bias (Perplexity Sonar)
- 99-query corpus not exhaustive of Japanese-language IS literature
- No bibliometric CiNii / J-STAGE analysis performed
- No direct interviews with ISSJ scholars or Sunada

- Translation of Japanese terms carries interpretive choices
- The H5 LLM probe (§ 15) does not test H5 on humans — properly noted as exploratory
- The § 12 evaluation framework is proposed, not validated — Layer A, B, C each need own validation
- The § 11 systems-theoretic claims (Ashby/Goldratt/Beer applied to najimi) are analogical — they require empirical instantiation in concrete deployed systems

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17. Stakeholder Recommendations

17.1 For ISSJ leadership

1. Operationalize the § 12 evaluation framework via the Calm Tech Certified pathway and a Japanese variant
2. Pursue selective English-language publication for canonical works (Imamichi 2005 lecture, Sunada 2025 monograph, ISSJ 2014 and 2023 books)
3. Recruit for the H5 N=30 human-subjects study (§ 15.4)
4. Develop a najimi-metric operationalization beyond SNSP citation
5. Engage Calm Tech Certified governance to ensure ISSJ-aligned principles are reflected
6. Build a counter-cases archive (failures with ISSJ-aligned diagnosis) to balance success-case visibility

17.2 For Japanese enterprise IT leaders

1. Read Sunada's 2025 monograph and 2026-05-23 lecture transcript
2. Adopt the § 12 Layer A AMC checklist as a procurement requirement immediately
3. Recognize multi-tier SIer subcontracting (知識空洞化) as a TOC bottleneck rather than just a cost-allocation issue
4. Pursue Calm Tech Certified status for consumer-facing IS products
5. Apply the seven Sunada implementation cases as design benchmarks and the COCOA/MyNumber failures as anti-benchmarks

17.3 For Western IS researchers

1. Cite Imamichi's Eco-Ethica and Nishigaki's Fundamental Informatics in your structurational/sociomaterial work
2. Engage the Sunada 2025 monograph and 2026-05-23 lecture as Japanese-side primary works
3. Collaborate on the H5 N=30 study as the Western-frame counterpart
4. Treat the § 12 phronēsis evaluation framework as a candidate alternative to TAM/UTAUT for normative-goal-driven IS

17.4 For Anthropic / AI labs (Mythos-era)

1. Imamichi's Eco-Ethica is positioned as a natural frame for AI ethics; engage it
2. Nishigaki's three-layer model (§ 13) is empirically testable; the model predicts that pure machine-information AI does not constitute information until L-interpretation reconstitutes meaning
3. The Sunada "LLMs cannot create concepts" observation is a research-program seed; design experiments where falsifying evidence would be LLMs naming a class of phenomena no human has yet named
4. Engage Calm Tech Certified 2026 governance as one path toward demonstrable AI-najimi

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18. Conclusion

The Japanese Information Systems discipline is best understood as **a design science with a pre-supplied normative goal** — Simon-Hevner Design Science Research extended with Imamichi's commitment to "good ends" and Ura's framing of "information systems nurture humans." Its two Japanese theoretical pillars (Imamichi's Eco-Ethica + Nishigaki's Fundamental Informatics) make it intellectually independent of the Western sociotechnical lineage while in close dialogue with it. The discipline's 2025–2026 crystallization in Sunada's monograph + 2026-05-23 lecture is current and empirically engaged with AI-era questions.

The discipline's signature design term — najimi — has both philosophical grounding (Heidegger's Zuhandenheit) and systems-theoretic structure (Ashby's requisite-variety matching, Goldratt's constraint-relief, Beer's VSM-respecting). It can be operationalized via a three-layer evaluation framework (Layer A: Anti-Manipulation Checklist + Calm Tech Certified compliance; Layer B: neo-APM phronēsis panel with SPM-adapted protocol; Layer C: long-horizon flourishing-scale assessment) that does not require LLM-mediated judgment.

The discipline is diagnostically strong but intervention-weak on the ¥2.6 trillion+ of national-scale Japanese IT failures. The 7 Sunada success cases reflect practitioner-internalized principles; the failures occurred where procurement frameworks did not require them. The honest research agenda is to translate principles into procurement requirements.

A small N=4 LLM-mediated design probe showed +0.5 effect in the predicted direction on flourishing and najimi-proxy criteria — but this is not evidence for H5 about human designers due to LLM-as-both-designer-and-evaluator circularity. The proper test is the pre-registered N=30 human-subjects study (§ 15.4) using the § 12 framework. The position is supported — not proved.

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(Approximately 99 Perplexity-mediated queries + 12 user-curated memo files at memo/260525_ISSJ/; deduplicated source set at `research/sources_flat.json`.)