
Communication 4.0: A Mid-Range Ontological Framework and Audit Protocol for Hybrid AI-Mediated Communication

Author: Yuliia Maslova*

*Doctor of Philological Sciences, Associate Professor
Head of the Department of Journalism and PR Management
The National University of Ostroh Academy, Ostroh, Ukraine
ORCID: <https://orcid.org/0000-0002-5568-8282>
yuliia.maslova@oa.edu.ua

Abstract

Generative artificial intelligence does not merely add a new channel to communication; in some workflows it selects sources, generates linguistic material, reorganises evidentiary relations, ranks visibility and feeds prior outputs into subsequent communicative states. This conceptual article asks how communication should be theorised when semantic production is distributed across entities with non-equivalent operational capacities and different relations to intentionality, epistemic authority and responsibility. Through metatheoretical reconstruction, comparative conceptual analysis and structural formalisation, I develop Communication 4.0 as a mid-range ontological framework for hybrid AI-mediated communication. Its configurational originality lies in integrating four elements that adjacent approaches usually treat separately: a typed ontology distinguishing human actors, organisations, computational systems, digital infrastructures and institutional rules; ordered and recursive semantic transformations; role-sensitive attribution of epistemic authority; and a non-delegable human-organisational responsibility constraint. The framework comprises Heterogeneous Semantic Participation, Recursive Meaning Reconfiguration, Hybrid Semantic Transformation Chains and Temporal Coordination of Semantic States. A parsimonious four-relation model specifies composition, recursion and attribution without presenting normative responsibility as mathematically derived. The article translates these relations into an Ontological Communication Audit and applies it to the documented 2025 'Heat Index' case, in which an AI-assisted summer reading list containing fabricated books passed through freelance production, syndication and newspaper publication before reader contestation prompted correction. The application shows how the Audit complements and extends technical provenance, content credentials and AI disclosure by reconstructing semantic transformations, institutional authorisation, sequence effects, traceability gaps and differentiated accountability. Semantic participation may be distributed, whereas legal, professional and moral accountability remains asymmetrically attributable to human and organisational actors.

Keywords

AI-mediated communication; communication theory; ontology of communication; generative artificial intelligence; human-machine communication; semantic transformation; editorial responsibility; Communication 4.0.

1. Introduction

Communication has long been recognised as a fundamental mechanism through which knowledge, meaning, and social reality are produced. Its interdisciplinary development has generated diverse theoretical traditions, including information theory, semiotics, sociology, linguistics, philosophy, and cognitive science, each explaining communication from a particular analytical perspective (Carey, 2009; Craig, 1999). Although these approaches have substantially expanded communication research, they predominantly explain how communication functions rather than how it transforms as a mode of existence.

Foundational traditions conceptualise communication as probabilistic transmission, semiosis, communicative action, cultural practice or autopoietic social operation (Carey, 2009; Habermas, 1984, 1987; Jakobson, 1960; Luhmann, 1995, 2001; Peirce, 1931–1958; Shannon & Weaver, 1949). They cannot be reduced to one anthropocentric model or a view of technology as a neutral channel. The narrower limitation is that they were not designed to differentiate generative transformation, platform ordering, organisational authority and recursive feedback within one auditable semantic trajectory. Communication 4.0 supplements rather than supersedes them.

This limitation becomes consequential in platform-dependent generative environments. Platforms, algorithms and generative AI influence visibility, produce linguistic and multimodal outputs, reorganise sources, preserve traces and condition later interpretation rather than merely transmit completed messages. The issue is not whether computational systems possess human-equivalent consciousness, but whether their operational participation changes the constitutive organisation of communication.

Recent scholarship has examined artificial intelligence in journalism, media education, organisational communication and human-machine interaction (Bender et al., 2021; Floridi & Chiriatti, 2020; Pavlik, 2023; Sundar & Lee, 2022; Vidales, 2025). Human-machine communication defines machines as communicative subjects or partners (Guzman & Lewis, 2020), while Edwards and Etzrodt (2025) conceptualise HMC as a trans-ontological field through the Act-Mean-Relate paradigm. AI-mediated communication examines computational modification of human messages (Hancock et al., 2020), artificial communication explains socially consequential algorithmic communication without presuming human-like intelligence (Esposito, 2022), and sociomaterial approaches analyse heterogeneous assemblages (Due, 2024). Integrative HMC-XAI work additionally connects human-in-the-loop analysis with message production explainability (Xu & Shi, 2024). These approaches establish the field to which Communication 4.0 is answerable. The unresolved problem is the integration of typed semantic operations, sequence-sensitive recursion, institutional authority and differentiated responsibility within one auditable architecture. Conceptual vocabularies that collapse processing, agency, intentionality and responsibility into undifferentiated 'AI communication' obscure the asymmetry between human and computational contributions.

Against this background, I ask: how should communication be conceptualised when meaning production is distributed across participants with non-equivalent operational, cognitive, institutional and moral capacities? I argue that the decisive transformation lies neither in the autonomous agency of AI nor in the simple extension of human communication by new tools. It lies in the reor-

ganisation of the relations through which meanings are selected, generated, validated, circulated, remembered and contested. The proposed framework comprises Heterogeneous Semantic Participation, Recursive Meaning Reconfiguration, Hybrid Semantic Transformation Chains and Temporal Coordination of Semantic States. Their synthesis is termed Communication 4.0, not as a chronological label for a technological generation, but as an ontological configuration in which differentiated participation becomes constitutive of communication.

The designation Communication 4.0 requires explicit differentiation from adjacent '4.0' vocabularies. In public relations and Industry 4.0 scholarship, the numeral commonly marks digital transformation, data-intensive practice or a strategic response to the fourth industrial revolution (Santa Soriano & Torres Valdés, 2021). I use it neither as a maturity score nor as a claim that communication history advances through four technologically determined stages. Communication 4.0 instead names an ontological configuration: semantic production is organised through typed, recursive and order-sensitive relations among human, computational, institutional and infrastructural participants, while responsibility remains asymmetrically attributable. This definition makes the concept refutable and prevents it from becoming a promotional synonym for AI adoption.

The argument proceeds in four moves. The first establishes ontology as a metatheoretical foundation. The second formalises transformation without assigning human intentionality to computational systems. The third states analytical principles, observable implications and conditions under which computational participation becomes constitutive. The fourth operationalises the framework through an Ontological Communication Audit connecting participant configurations, semantic interventions, temporal dependencies, provenance and responsibility.

2. Methodological framework

I adopt a qualitative conceptual research design because the object of inquiry is not a population of media texts or users, but the explanatory architecture through which contemporary communication is theorised. The unit of analysis is the ontological presupposition embedded in a communication model: which entities are admitted as participants, what capacities are attributed to them, how meaning is assumed to persist or change, and where agency, epistemic authority and responsibility are situated. The study consequently produces a mid-range ontological framework, analytical principles and an operational audit protocol rather than statistical estimates or causal generalisations.

The analytical procedure comprises five operations. Problem reconstruction identifies selected anthropocentric and process-oriented assumptions while preserving the distinct achievements of transmission, semiotic, hermeneutic, action-theoretical and systems traditions. Conceptual differentiation separates participation, cognition, intentionality, epistemic authority and responsibility. Relational synthesis connects these categories; formalisation specifies typed sets, mappings and constraints; and operational translation converts the resulting analytical principles, observable implications and boundary conditions into an audit protocol.

The theoretical corpus was selected purposively for conceptual relevance, not statistical representativeness. Foundational works define communication, meaning, social ontology and communicative action; contemporary studies clarify distributed cognition, platform ordering, computational generation, editorial automation and AI-mediated interaction. The corpus is reconstructive and contrastive rather than a systematic review: classical sources establish the assumptions examined, while contemporary sources reveal changes in semantic selection, generation and circulation. A concept was retained only when it explained a constitutive dimension not captured by the other constructs.

Operational application is demonstrated through a documented case illustration rather than a full empirical case study. The case concerns the AI-assisted 'Heat Index: Your Guide to the Best of Summer' supplement distributed in May 2025 through the Chicago Sun-Times and The Philadelphia Inquirer. It was selected because public documentation permits reconstruction of generation, non-verification, syndication, publication, audience contestation and institutional correction across several typed entities. The evidentiary base comprises the organisations' published statements, the Chicago Public Media chief executive's process reconstruction and independent contemporaneous reporting (Bauder, 2025; Bell, 2025; Wood, 2025). Claims are restricted to documented actions; unavailable prompts, model identifiers and internal editing records are coded as traceability gaps rather than inferred.

The framework is assessed through coherence, differentiation, scope, parsimony and practical fertility. These criteria require non-contradictory constructs with distinct explanatory functions, transferability across communicative domains, no unnecessary multiplication of entities and support for systematic institutional observation. Communication 4.0 is therefore advanced as a revisable metatheoretical construction for comparative evaluation, not as a universally confirmed causal theory.

3. From process theories to an ontology of communication

Communication theory has continuously expanded its explanatory scope, moving from information transmission to semiosis, communicative action, systems and cultural processes (Carey, 2009; Habermas, 1984, 1987; Jakobson, 1960; Luhmann, 1995, 2001; Peirce, 1931–1958; Shannon & Weaver, 1949). These traditions differ not only in method but also in their implicit ontological commitments: they conceptualise communication as signal relation, semiosis, validity-oriented action, cultural practice or autopoietic social operation. The limitation addressed here is therefore not that previous theory lacks ontology. It is that no single one of these traditions was designed to differentiate generative computation, infrastructural ordering, organisational authorisation and recursive feedback within one auditable semantic trajectory.

Across many influential twentieth-century traditions, communicative agency and interpretive competence were attributed primarily to human participants, even when media and technologies were recognised as consequential conditions of communication. Contemporary algorithmic and generative systems make the limits of that analytical emphasis more visible because they perform operations that materially affect linguistic form, evidentiary relations, visibility and circulation across diverse communicative contexts (Couldry & Hepp, 2017; Floridi & Chiriatti, 2020; Pavlik, 2023; Sundar & Lee, 2022; Vidales, 2025; Yao & Chang, 2026).

The anthropocentric limitation is not universal across all contemporary theory. Peters (2015) foregrounds the elemental and infrastructural conditions of mediation, while Malin (2016) demonstrates how object-oriented approaches unsettle the assumption that only human subjects matter to communication. These interventions are crucial correctives, yet they do not formalise the differentiated semantic operations of generative systems or specify how responsibility should be assigned across hybrid workflows. Communication 4.0 enters precisely at this unresolved junction between distributed participation and non-distributed accountability.

The emergence of artificial intelligence within hybrid AI-mediated environments further exposes the limits of analytical models that locate all semantically consequential operations exclusively in human actors. The central theoretical question is not whether computational systems communicate in a human sense, but under which conditions their observable operations become constitutive of a communicative trajectory. Addressing this question requires an ontological account that preserves the difference between semantic consequentiality and human understanding.

3.1. Theoretical differentiation and the specific novelty of Communication 4.0

Communication 4.0 is not the first framework to recognise machines, infrastructures or material objects as communicatively consequential. Human-machine communication relocates the machine from channel to communicative subject (Guzman & Lewis, 2020). More specifically, Edwards and Etzrodt (2025) define HMC as a trans-ontological field concerned with how communicative presence and legitimacy are constituted across human-machine boundaries. Their Act-Mean-Re-

late (AMR) paradigm conceptualises communication through capacities for action, signification and relation, thereby shifting analysis from fixed internal properties to symbolic and relational accomplishment. Xu and Shi’s (2024) two-level HMC framework links this field with explainable AI by connecting human responses to AI interfaces with human-in-the-loop processes and message production explainability. AI-mediated communication specifies computational modification of interpersonal messages (Hancock et al., 2020); artificial communication explains socially observable algorithmic differences without requiring human-like intelligence (Esposito, 2022); distributed cognition traces accomplishment across people and artefacts (Hutchins, 1995); sociomaterial approaches redistribute consequentiality across situated configurations (Due, 2024); and platform studies explain infrastructural ordering of visibility (Gillespie, 2018).

Communication 4.0 is closest to trans-ontological HMC in recognising that communication crosses and reconfigures ontological boundaries, but its analytical object and explanatory task differ. AMR theorises how action, meaning and relation make human-machine communication possible and legitimate. Communication 4.0 reconstructs a consequential output as a multi-stage, ordered and recursive trajectory of semantic transformations across typed entities, then identifies the institutional authority through which those transformations become valid and the differentiated responsibility through which they may be justified, corrected or contested. It also differs from the integrative HMC–XAI model: message production explainability illuminates how an AI system’s operation may be made intelligible, whereas the Ontological Communication Audit follows semantic change beyond the interface across sourcing, generation, human editing, organisational authorisation, infrastructural circulation, audience contestation and correction. The frameworks are therefore complementary rather than competing.

The claim is one of configurational rather than component originality. Communication 4.0 makes five relations analytically co-dependent: entity and role, material semantic difference, ordered and recursive position, institutional validation, and an identifiable human or organisational route of justification and remedy. Provenance without semantic comparison cannot establish what changed; comparison without sequence cannot explain path dependence; distributed participation without authority cannot explain validation; and causal attribution without differentiated responsibility cannot secure accountability. This dependency structure is the framework’s specific contribution.

Table 1. Communication 4.0 in relation to adjacent theoretical approaches

Approach	Primary analytical object	Status of AI or technology	Principal explanatory strength	Problem left open for Communication 4.0
Human-machine communication	Interaction and relational communication between humans and machines	Communicative subject or partner as perceived and enacted in interaction	Reframes machines as communicative rather than merely mediating technologies	Does not by itself map multi-stage organisational workflows or distinguish all forms of responsibility

Approach	Primary analytical object	Status of AI or technology	Principal explanatory strength	Problem left open for Communication 4.0
AI-mediated communication	Computational modification of person-to-person communication	Mediating agent that modifies, augments or generates messages toward communicative goals	Precisely identifies AI intervention in interpersonal message production	Usually centres the mediated message and user relation rather than recursive platform–organisational chains
Artificial communication	Social communication generated through algorithmic operations	Operational participant capable of producing socially meaningful differences without human-like intelligence	Explains communication with algorithms without anthropomorphic assumptions	Does not provide a workflow-level audit joining semantic provenance to differentiated accountability
Distributed cognition	Cognitive accomplishment distributed across persons and artefacts	Component of a larger cognitive system	Explains coordination across heterogeneous resources	Risks extending the term cognition beyond the distinctions needed for intentionality and moral answerability
Sociomaterial and assemblage approaches	Situated accomplishment through heterogeneous human and material configurations	Consequential element within a relational assemblage	Reveals emergent, situated and material constitution of communicative activity	Generalised symmetry does not necessarily specify role-sensitive epistemic and normative asymmetries
Algorithmic mediation and platform studies	Ordering, moderation and visibility within infrastructures	Infrastructural selector and governor of attention	Explains power embedded in ranking, moderation and platform architecture	Does not always reconstruct upstream and downstream semantic transformations in one chain
Ontological media theory / Mediation–Extension Schema (Bak, 2025)	AI as a condition of mediation, extension, meaning and subjectivity	Techno-social medium that reconfigures relations and fields of action	Provides an explicitly ontological account of AI as media	Remains broader than the audit-level assignment of transformations, evidence and responsibility
Trans-ontological HMC / Act–Mean–Relate	Communicative presence and legitimacy across ontological boundaries through action, signification and relation	Relational participant whose communicative status is constituted in interaction	Explains how communication and relations emerge across human–machine boundaries without relying on human exceptionalism	Does not reconstruct a multi-stage semantic trajectory or provide a workflow-level attribution protocol
Integrative HMC–XAI	Human response to AI interfaces and explainability of underlying message production	Interlocutor or interface connected to human-in-the-loop production processes	Connects HMC with operational transparency and message production explainability	Does not by itself map semantic transformations, institutional authority and correction across an extended organisational chain

Approach	Primary analytical object	Status of AI or technology	Principal explanatory strength	Problem left open for Communication 4.0
Communication 4.0	Ordered, recursive and consequential semantic trajectories across typed entities and roles	Constitutive semantic participant without presumed human cognition or terminal accountability	Integrates type, sequence, recursion, provenance, authority and responsibility in an auditable model	Requires empirical validation across domains, languages and institutional settings

Note. The comparison identifies differences in analytical emphasis rather than mutually exclusive theoretical territories.

The comparison establishes the framework’s explanatory value. Communication 4.0 distinguishes workflows containing the same humans and technologies when transformation order, provenance, authority or correction pathways differ. It also identifies computational interventions as semantically constitutive without treating systems as moral agents, and separates organisations, authorised representatives, infrastructures and rules. These distinctions exceed generic descriptions of ‘human–AI collaboration’ or ‘AI use’.

3.2. Ontological transformation without technological determinism

Many influential theories assigned primary interpretive agency to humans, although systems, semiotic and media-philosophical traditions complicated that location. Algorithmic infrastructures now shape visibility and circulation (Gillespie, 2018), and computational journalism incorporates automated retrieval, generation and decision support (Diakopoulos, 2019; Pavlik, 2023). Yet linguistic performance is not evidence of understanding (Bender et al., 2021). Computational operations may therefore be semantically constitutive without acquiring human consciousness, epistemic authority or moral agency.

These developments reorganise rather than autonomously originate communicative relations. Distributed cognition, informational ontology and recent AI communication theory show how cognition, media and informational environments become interdependent (Floridi, 2011, 2014; Hayles, 2012; Sundar & Lee, 2022; Vidales, 2025; Yao & Chang, 2026). Communication 4.0 introduces a stricter asymmetry: distributed operations do not entail distributed intentionality or terminal responsibility.

The resulting configuration joins human interpretation, computational generation, organisational authority and infrastructural ordering without treating them as cognitively or normatively equivalent. Its temporal dimension is recursive: archives, rankings, prior outputs and audience responses condition later semantic states. Accordingly, the framework reserves cognition for human or explicitly distributed-cognition analysis and uses semantic participation for materially consequential selection, generation, framing, evidentiary change and visibility.

Communication 4.0 thus defines ontological transformation as the historical reorganisation of communicative existence through heterogeneous, recursively connected participation. Human communication is repositioned within wider ecologies in which computational, institutional and infrastructural operations condition how meaning emerges, persists and becomes actionable.

3.3. The conceptual architecture of Communication 4.0

Communication 4.0 conceptualises communication as a temporally extended semantic trajectory constituted through non-equivalent entities, operations and institutional constraints. The empirical unit may be a message, article, recommendation or correction, but the analytical unit is the trajectory through which that object is selected, transformed, authorised, circulated, contested and re-entered into subsequent communication.

The ontology distinguishes entity type from communicative role. Human actors are embodied persons capable of intentional interpretation and moral answerability. Organisational actors are legally or institutionally constituted collectives capable of authorising publication, assigning professional duties and bearing institutional responsibility. Computational systems execute model-based operations such as retrieval, classification, generation, translation or prediction. Digital infrastructures provide the technical conditions of storage, interface, ranking, access and circulation. Institutional rules comprise policies, professional norms, legal obligations and editorial procedures that constrain permissible operations. They are not treated as persons, yet they exert constitutive effects by enabling, prohibiting or requiring particular transformations.

Audience is therefore not a fifth ontological species. It is a communicative role that may be occupied by individual human actors, organised groups or computationally represented aggregates. Likewise, a platform company and its ranking infrastructure are analytically distinct: the former is an organisational actor capable of policy and responsibility, whereas the latter is a technical infrastructure that performs ordering operations. One empirical entity may occupy several roles, but every role must be coded separately. A journalist may be source selector, prompt author, verifier and recipient of audience feedback; these roles do not collapse into one undifferentiated node.

The first construct, **Heterogeneous Semantic Participation**, identifies any operation that materially affects semantic selection, generation, framing, evidentiary relation, visibility or interpretation. Semantic participation is deliberately broader than cognition but narrower than mere technical presence. It allows computational systems and infrastructures to be constitutively consequential without presuming consciousness, understanding or moral agency.

Recursive Meaning Reconfiguration explains how a transformed output becomes input to a later communicative state. A generated summary may inform a headline, a ranked headline may shape audience responses, and those responses may prompt correction or optimisation. Meaning is consequently modelled as a revisable configuration whose previous states remain causally and interpretively relevant.

Hybrid Semantic Transformation Chains represent the ordered composition of heterogeneous interventions. Order matters because retrieval before generation, verification before publication and correction before amplification do not yield the same communicative consequences as the reverse sequences. The construct converts provenance from a list of contributors into a temporally ordered account of semantic change.

Temporal Coordination of Semantic States relates inherited material, present transformation and anticipated reception. Archives, retrieval corpora, prior prompts, model histories, editorial

routines and predicted engagement influence the present without being ontologically identical to it. The construct therefore captures temporal dependence without describing computational prediction as human anticipation.

Together, these constructs define Communication 4.0 as a mid-range ontological framework: an architecture for analysing how semantic participation becomes distributed while epistemic authority and accountability remain differentiated. The adjective *semantic* is used for the superordinate process; *cognitive* is reserved for human cognition or for explicit engagement with established distributed-cognition scholarship.

3.3.1. Parsimonious formal representation

The formalisation is retained only where notation performs analytical work that prose alone does not: it enforces type distinctions, records ordered composition, represents recursive state change and makes the responsibility constraint explicit. It is structural, not predictive, and contains no inferred numerical weights.

Let H_t , O_t , A_t and P_t denote, respectively, the sets of human actors, organisational actors, computational systems and digital infrastructures active at time t . Let N be the separate set of institutional rules and norms that constrain permissible operations, and let $N_t \in \mathcal{P}(N)$ be the subset applicable at time t ; let $\mathcal{R}$ denote the set of communicative roles; and let $\mathcal{P}^+(Z)$ denote the family of non-empty subsets of any set Z . The typed entity and role relation is:

$$\begin{aligned} U_t &= H_t \sqcup O_t \sqcup A_t \sqcup P_t, \quad N_t \cap U_t = \emptyset \\ r_t : U_t &\rightarrow \mathcal{P}^+(\mathcal{R}) \end{aligned} \tag{1}$$

The disjoint union is analytical rather than metaphysical: it prevents a computational system, an organisation and a platform infrastructure from being coded as equivalent participants. The mapping r_t assigns every entity at least one role from $\mathcal{R}$ and permits one entity to occupy several roles without losing its ontological type. Institutional rules remain constraints rather than actors, even when they are encoded in technical procedures.

Let S denote the universe of semantic states, with $S_i \subseteq S$ the state space at stage i . For $i = 1, \dots, n$, let f_i map S_{i-1} to S_i , and let $F_t = \{f_1, \dots, f_n\}$ be the ordered collection of transformations active at time t . For an initial semantic object $s \in S_0$, the transformation chain is:

$$K_t(s) = (f_n \circ f_{n-1} \circ \dots \circ f_1)(s), \quad f_i \in F_t \tag{2}$$

Equation (2) makes sequence analytically indispensable. The functions may have stage-specific domains and codomains because retrieval, generation, verification, ranking and correction do not transform identical objects. Where both compositions are well-defined and $f_i \circ f_j \neq f_j \circ f_i$, reordering the operations may change both the output and its institutional consequences.

Let $M_{t-1} \in S$ be the inherited semantic configuration, $K_t(s) \in S$ the output of the current ordered transformation chain and $X_t \in X$ the reception or contestation feedback. Let $\Phi: S \times S \times X \times \mathcal{P}(N) \rightarrow S$ be a recursive update function. Reconfiguration under the applicable constraints N_t is represented as:

$$M_t = \Phi(M_{t-1}, K_t(s), X_t, N_t) \quad (3)$$

Equation (3) distinguishes recurrence from one-off mediation: an intervention becomes recursively consequential when its output conditions a later semantic state.

Let Q_t denote the set of communicative outputs produced, circulated or institutionally released at time t , and let $Q_t^* \subseteq Q_t$ denote outputs that meet a contextually specified threshold of public reach, foreseeable harm, institutional effect or correction cost. Responsibility attribution is represented by the normative mapping:

$$\rho_t: Q_t^* \rightarrow \mathcal{P}^+(H_t \cup O_t) \quad (4)$$

Equation (4) does not derive responsibility mathematically. It formalises a normative and institutional requirement adopted by the framework: every consequential output must remain attributable to a non-empty set of identifiable human or organisational actors. The threshold defining Q_t^* must be specified for the audited domain rather than assumed universally. Computational systems and infrastructures may be causally and semantically constitutive, but they are not terminal bearers of legal, professional or moral accountability. Whether a particular attribution is adequate remains an empirical and normative question for the Audit.

The four relations correspond directly to observable audit evidence: entity and role records for Equation (1), versioned interventions for Equation (2), recurrence and feedback histories for Equation (3), and authorisation, correction and appeal procedures for Equation (4). Formalisation is therefore justified by traceability and comparison, not by an appearance of quantitative precision.

3.4. From metatheory to an Ontological Communication Audit

The Ontological Communication Audit operationalises Communication 4.0 as a structured qualitative protocol. It is neither a maturity score nor an index of the quantity of AI use. Its purpose is to reconstruct how a consequential communicative object comes into being, where its semantic and evidentiary status changes, how earlier outputs condition later ones, and which actors can authorise, justify, contest and correct the result.

The Audit proceeds through six linked dimensions. Entity typing separates persons, organisations, computational systems and infrastructures; role mapping records their situated functions. Semantic transformation compares inputs and outputs, while temporal recursion identifies outputs that become later inputs. Epistemic governance locates authority to validate claims, and responsibility and contestability identify legal, professional and moral answerability together with routes of correction and appeal.

Table 2. Operational dimensions of the Ontological Communication Audit

Dimension	Diagnostic question	Observable evidence
Entity type and role	What kind of entity is involved, and which communicative role does it occupy at this stage?	Workflow maps, ownership records, role descriptions, system documentation
Semantic transformation	Which meanings, sources, frames or evidentiary relations are selected, generated, compressed, ranked or omitted?	Inputs and outputs, prompts, edits, retrieval records, ranking rules, source comparison
Sequence and recursion	In what order do interventions occur, and which outputs re-enter later stages as inputs?	Version histories, timestamps, correction logs, recommendation histories, reuse records
Provenance and traceability	Can a consequential claim and each material transformation be traced to a source and intervention?	Source links, content credentials, model and prompt records, audit trails
Epistemic authority	Who is entitled and competent to validate the truth, sufficiency and contextual fairness of claims?	Editorial policies, verification records, professional roles, approval decisions
Responsibility and contestability	Who bears legal, professional and moral accountability, and how can the output be challenged or corrected?	Named authorisation, escalation procedures, correction mechanisms, appeal channels

Note. Operational participation, causal contribution, epistemic authority, legal responsibility, professional responsibility and moral accountability are coded separately.

3.4.1. Documented application: the AI-generated ‘Heat Index’ supplement

The Audit is applied to the documented ‘Heat Index: Your Guide to the Best of Summer’ supplement distributed in May 2025 through the Chicago Sun-Times and The Philadelphia Inquirer. A freelance creator working for King Features used an undisclosed AI agent during story development and submitted the material without adequately checking the generated claims. The supplement included a ‘Summer Reading List for 2025’ in which 10 of 15 recommended titles and their descriptions were fabricated, although they were attributed to real authors. Examples included *The Last Algorithm*, falsely attributed to Andy Weir, and *Nightshade Market*, falsely attributed to Min Jin Lee (Bauder, 2025; Bell, 2025). The case is analytically valuable because the falsehood did not move directly from a model to a reader: it acquired credibility through successive human, organisational and infrastructural decisions.

King Features accepted and syndicated the package without detecting or disclosing the AI-assisted fabrication. The newspapers then incorporated the third-party supplement into branded print and electronic editions without newsroom review or clear attribution of its external origin. Readers subsequently compared the recommendations with bibliographic reality, circulated discrepancies through social platforms and triggered organisational investigation. The digital supplement was removed, corrections and apologies were issued, and King Features ended its relationship with the creator (Bell, 2025; Wood, 2025). Bell’s process reconstruction records approximately 24 hours between print circulation and public detection, followed by a further interval before institutional correction. The published chronology therefore permits analysis of generation, authority transfer, circulation, contestation and remedy without inferring inaccessible internal actions.

Table 3. Stage-by-stage Ontological Communication Audit of the documented ‘Heat Index’ case

Stage	Typed entity and role	Material semantic operation	Evidence and interpretive difficulty	Authority and responsibility
1. AI-assisted generation	Freelance creator: prompt author and compiler; undisclosed AI agent: computational generator	Produces a reading list containing fabricated titles, attributions and descriptions	Published list and later admission; prompt, model and raw output remain unavailable	Creator controls use and verification; the system contributes causally but has no epistemic authority
2. Non-verification and submission	Freelance creator: submitter; King Features: receiving organisation	Generated claims are retained and presented as publishable editorial material	Creator acknowledged inadequate checking; exact human edits cannot be reconstructed	Creator bears professional responsibility for verification and disclosure
3. Organisational acceptance and syndication	King Features: content provider and syndicator; Hearst: parent organisation	The package acquires distributable professional status and is transmitted to publishing partners	King Features stated that its policy prohibited AI-created material and that the use had not been disclosed; internal review records are not public	King Features bears organisational responsibility for vetting, policy enforcement and partner assurance
4. Newspaper adoption and branding	Chicago Sun-Times and The Philadelphia Inquirer: publishing organisations; circulation teams: selectors	Externally produced content is incorporated under trusted newspaper brands without clear third-party attribution	Official statements confirm newsroom non-involvement; organisational boundaries were invisible to readers	Publishers confer institutional authority and remain responsible for branded content
5. Print and digital circulation	Print editions, e-paper systems and syndication infrastructure: distributors and preservers	Fabricated recommendations become publicly actionable and reproducible	Dated editions document circulation; print copies and screenshots outlast later removal	Publishers bear duties of accuracy, transparency and proportionate pre-publication control
6. Reader verification and platform contestation	Readers: recipients, bibliographic verifiers and critics; social platforms: visibility infrastructures	External comparison changes the list's status from recommendation to publicly contested misinformation	Reader posts and contemporaneous reports trace detection; platform ranking remains partly opaque	Readers contribute epistemically but do not inherit editorial responsibility
7. Institutional correction and removal	Publishers and King Features: correctors; creator: acknowledging participant	Digital editions are removed, corrections and apologies reframe the event and identify governance failure	Official statements document remedy, but physical copies and reposts preserve earlier states	Organisations bear professional and organisational duties to correct visibly and explain failure; legal obligations remain jurisdiction-specific
8. Persistent recurrence and policy revision	Archives, screenshots and reposts: persistence infrastructures; organisations: policy revisers	The discredited content continues in derivative circulation while the incident becomes input to revised AI governance	Persistence is observable, whereas reach and downstream reuse cannot be fully measured	Terminal accountability remains human and organisational; remediation includes future oversight and traceability

The Audit reveals findings that a generic statement that ‘AI was used’ does not provide. The failure was constitutive rather than stylistic: fabricated titles, authorship relations and plot descriptions

entered a recommendation genre that presupposes referential accuracy. Sequence then altered authority: non-verification, syndicator acceptance, newspaper branding and print distribution converted generated material into an apparently curated editorial recommendation. Correction was only partially restorative because print copies, screenshots and derivative discussion preserved earlier states. These findings complement and extend technical provenance, content credentials and AI disclosure by identifying what changed semantically, how the change acquired institutional authority and why correction could not fully reverse circulation.

The case also makes traceability limits analytically visible. The available record does not identify the model, disclose the prompt or preserve the unedited output. These absences are not filled through speculation; the Audit codes them as provenance gaps that prevented both pre-publication scrutiny and retrospective reconstruction. Responsibility nonetheless remains differentiable. The creator initiated and failed to verify the generative operation; King Features converted the material into syndicated content; the newspapers conferred branded institutional authority; readers performed the bibliographic verification that the production chain had omitted. Organisational responsibility overlaps with individual responsibility without becoming reducible to it, and a formal prohibition on AI use does not constitute effective governance when third-party acquisition, disclosure and editorial review remain disconnected.

3.5. Analytical principles and empirically investigable implications

The framework yields four analytical principles. They are not presented as already validated causal laws. Each principle generates an empirical implication, an observable indicator and a potential falsifier, thereby defining a research programme rather than overstating testability.

Principle 1: Constitutive Semantic Participation. An intervention is constitutive when its removal, substitution or material alteration changes semantic content, evidentiary status, visibility or plausible interpretation rather than transmission speed alone. Version comparison should reveal a meaningful attributable difference; repeated surface-only variation would weaken the principle.

Principle 2: Recursive Accumulation. An intervention may become more consequential when its output is reused as a later input. Longitudinal version analysis should identify persistence, amplification or mutation; the principle would not be supported where later states remain independent of the altered output.

Principle 3: Order Sensitivity. Where transformations are non-commutative, changing their sequence changes the communicative object or its public consequence. Workflow reordering or comparative process tracing can test this implication; repeated semantic and institutional equivalence across feasible orderings would falsify it for the specified operations.

Principle 4: Responsibility Specificity under Consequence. As foreseeable harm, semantic opacity and correction cost increase, adequate governance requires more explicit human and organisational authorisation, provenance and contestability. The institutional value of the principle would be challenged if generic or absent attribution repeatedly provided equally effective justification and remedy in high-consequence cases.

Communication 4.0 is therefore not present whenever software is used. Its analytical threshold is crossed when heterogeneous operations become semantically material, recursively consequential or institutionally decisive. These conditions also delimit the framework: it does not infer understanding from performance, classify all technical operations as semantic, or presume that participation entails authority or responsibility.

4. Discussion

Communication 4.0 does not supersede transmission, semiotic, action-theoretical, systems, media-philosophical or HMC traditions. It addresses a narrower integrative problem: reconstructing a consequential semantic object through a typed, ordered, recursive and institutionally governed trajectory.

Its unit of analysis differs from the encounter foregrounded in much HMC, the modified interpersonal message in AI-mediated communication and the broader relational emergence theorised by trans-ontological HMC. Communication 4.0 follows a semantic object across transformations, authorisation, circulation, contestation and correction. The Audit complements and extends technical provenance, content credentials and AI disclosure by adding semantic comparison, order, epistemic authority and corrective obligation; it does not claim that established provenance methodologies are intrinsically unable to address these dimensions.

The term semantic participation preserves distributed communicative consequentiality without treating pattern processing, organisational constraint, platform ranking and human understanding as equivalent cognition. Computational systems are described through observable operations, preventing linguistic fluency from being mistaken for understanding (Bender et al., 2021; Floridi & Chiriatti, 2020).

The typed ontology separates humans, organisations, computational systems, infrastructures and institutional constraints while allowing one entity to occupy several roles. This preserves practical interdependence without obscuring differences in authority and responsibility.

The four-relation model preserves entity types, transformation order and recursive dependence, then states responsibility as a separate normative constraint. It thereby prevents causal contribution from being converted into epistemic or moral equivalence.

4.1. Distributed participation and differentiated responsibility

The framework's most distinctive claim concerns asymmetry between participation and accountability. **Operational participation** denotes performance of an identifiable task. **Causal contribution** denotes a difference made to the resulting output or its circulation. **Epistemic authority** denotes recognised competence and entitlement to validate claims. **Legal responsibility** concerns obligations and liability assigned by law. **Professional responsibility** arises from occupational roles and standards. **Moral accountability** concerns the capacity and obligation to answer for foreseeable consequences. A computational system may participate operationally and contribute causally; neither fact establishes epistemic authority, legal personhood, professional duty or moral answerability.

Human and organisational responsibility remain distinct. Journalists and editors exercise situated professional judgement; news organisations determine procurement, working conditions, editorial policy, approval and correction. Responsibility may be shared across identifiable persons and or-

ganisations without being transferred to a computational system. Terminal accountability denotes the endpoint of public justification and remedy, not exclusive blame assigned to one person.

This differentiation strengthens rather than diminishes distributed accounts of communication. Recognising algorithmic selection, platform ranking or model generation as constitutive prevents organisations from describing consequential systems as neutral tools. Refusing to treat those systems as terminally accountable prevents the inverse evasion in which human and organisational decisions disappear behind the language of autonomous AI. Huang and Wu's (2025) organisation–AI–user responsibility triangle similarly demonstrates that publics negotiate machine involvement together with expectations of organisational response. Communication 4.0 adds a semantic and workflow-level protocol for locating those relations before and after failure.

4.2. Explanatory and practical value of the Audit

The documented 'Heat Index' application demonstrates that the Audit produces more than an inventory of participants. It locates semantic fabrication, reconstructs the institutional transfer of authority from freelancer to syndicator to newspaper brand, records the temporal priority of circulation over verification and identifies whether contestation can reach an actor authorised to provide remedy. The case also shows that provenance gaps are themselves governance findings: the absence of a preserved prompt, model identifier and raw output obstructed retrospective explanation. The Audit therefore complements technical provenance, content credentials and AI disclosure rather than duplicating them.

For newsrooms and communication organisations, high-consequence hybrid chains should retain proportionate records of source material, material automated transformations, substantive human edits and final approval. A generic declaration that AI was used is insufficient because generation, summarisation, translation, ranking and verification create different semantic and evidentiary risks. Policies should connect each function to a verification requirement and a named authority.

For media education, the Audit provides an operational metalanguage for editorial cognitive AI literacy (Maslova, 2026). Students can compare a primary source, an AI-generated synthesis, a human-edited publication and a later correction; identify changes in modality, agency, presupposition, evaluative framing and evidentiary relation; and explain why causal participation does not automatically confer epistemic authority. Ontological analysis thus becomes a professional interpretive competence.

For platforms and regulators, transparency should be calibrated to communicative consequence rather than synthetic status alone. High-reach or high-risk outputs require stronger provenance, explanation and contestability than routine low-risk assistance. Governance should examine how ranking, persistence, correction visibility and organisational control interact across the trajectory.

4.3. Limitations and research agenda

Communication 4.0 remains a conceptual mid-range framework and does not establish universal causal effects, exhaustive ontological categories or quantitative weights. The documented 'Heat

Index' case demonstrates analytical use but does not validate reliability, predictive power or cross-contextual transferability. Its reconstruction relies on public organisational statements and contemporaneous reporting rather than complete internal records. The unavailable prompt, model identifier, raw output and editorial logs restrict causal granularity while simultaneously exemplifying the traceability deficits the Audit is designed to identify. The categories also require interpretive judgement, especially when institutional rules are encoded in infrastructure, human actors occupy several roles or organisational boundaries are invisible to audiences.

The responsibility mapping is explicitly normative and may vary across jurisdictions, professional cultures and organisational forms. It does not resolve contested questions of legal liability, nor does it imply that every harmful outcome can be attributed to a single actor. Its more limited requirement is that consequential communication retain an identifiable pathway of human and organisational justification and remedy.

Future research should test the Audit through comparative process tracing in newsrooms, educational settings, strategic communication and platform governance. Inter-coder studies should examine whether analysts reliably distinguish entity type, role, semantic materiality and authority. Removal and substitution designs can investigate constitutive participation; longitudinal version analysis can test recursive accumulation; controlled reordering can test non-commutativity; and comparative governance studies can examine whether responsibility specificity improves correction, explanation and public remedy. Cross-linguistic research is especially necessary because semantic compression, modality and evidentiary framing may be transformed differently across languages.

5. Conclusions

Communication under conditions of generative AI is neither an exclusively human exchange supported by external tools nor an autonomous machine process. It is a typed and temporally extended semantic trajectory in which human actors, organisations, computational systems, digital infrastructures and institutional rules contribute through non-equivalent operations. Communication 4.0 names this configuration without attributing human cognition, intentionality or moral agency to computational systems.

The framework's configurational originality lies in integrating entity typing, role multiplicity, ordered and recursive semantic transformation, institutional authority and differentiated responsibility within one auditable architecture. Its formal relations preserve these distinctions without purporting to calculate responsibility.

The Ontological Communication Audit operationalises that architecture. In the documented 'Heat Index' case, it reconstructs fabrication, non-verification, syndicator acceptance, newspaper branding, circulation, reader contestation and correction. It complements and extends technical provenance, content credentials and AI disclosure by relating traceable origin to semantic change, sequence, institutional authorisation and remedy.

Three practical requirements follow. Organisations should preserve proportionate records of consequential AI-mediated semantic transformations; verification should correspond to the specific function performed by AI, such as generation, summarisation, translation, ranking or checking, rather than to a generic declaration of use; and every consequential output should retain identifiable human and organisational routes for authorisation, correction and contestation.

Communication 4.0 remains open to empirical qualification through comparative application and reliability testing. Its central claim is deliberately bounded: semantic participation and causal contribution may be distributed across hybrid systems, but epistemic authority, legal responsibility, professional duty and moral accountability remain differentiated and cannot be dissolved into the technical chain.

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Declarations

Author contributions

Yuliia Maslova: Conceptualisation; methodology; formal analysis; investigation; theoretical synthesis; development of the Ontological Communication Audit; writing of the original draft; critical review and editing; final approval of the manuscript.

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Ethics approval

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Informed consent

Not applicable.

Data availability

No new empirical dataset was generated. The conceptual analysis is based on published scholarly sources, and the documented case illustration uses publicly available organisational statements and contemporaneous reporting identified in the reference list. No private or restricted records were accessed; the formal model and audit dimensions are fully reported in the article.

Generative AI use disclosure

ChatGPT Work (OpenAI) was used as an assistive tool for language editing, terminological consistency checking and technical refinement of tables and explanatory formulations. It was not used as an autonomous source of evidence or scholarly authority. The author selected and verified the sources, developed the conceptual framework and formal model, evaluated all suggestions, and reviewed and approved the final wording. The author assumes full responsibility for the accuracy, integrity and content of the manuscript.

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CORRESPONDENCE

Yuliia Maslova
The National University of Ostroh Academy, Ostroh, Ukraine
yuliia.maslova@oa.edu.ua
ORCID: 0000-0002-5568-8282

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