GOVERNED AUTONOMY

CHROMATIC: Ambient Assistance Under Continuing Human Authority

A paper in the Governed Autonomy collection

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Research on authority, evidence, and continuity in autonomous systems.

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CHROMATIC: Ambient Assistance Under Continuing Human Authority

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Research study: conceptual exposition of the CHROMATIC specification
Source: Public exposition, successor 2026.10.8; historical research and evidence separately qualified

Abstract

Ambient assistance promises to reduce the work of maintaining a digital environment: finding a document after its name changes, keeping related materials together, preparing a recurring draft, and turning spoken intent into useful work. The promise becomes difficult when the system can observe continuously, learn from behavior, and act while the person is occupied elsewhere. Observation can be mistaken for consent, repetition for permission, a plausible interpretation for an instruction, and a reversible-looking action for one that can actually be undone.

CHROMATIC studies these problems through a proposed local-first assistance system: routine observation and reasoning stay on the person's machine, while any remote processing remains subject to separate information and model policies. Its conceptual contribution is to separate permission to observe, permission to act, and evidence that a learned behavior is useful. The proposal connects environmental maintenance, direct expression of intent, and learning from recurring work under an independently enforced authority boundary. Quiet operation depends on a continuing authorization. Four scenarios examine how this arrangement could support useful assistance while preserving control. Evaluation distinguishes learned competence, permission, recording, and reversibility by behavior class. Implementation and effectiveness require evidence across those boundaries.

1. The problem of useful background work

Digital work accumulates maintenance costs that are individually small and collectively persistent. A person gathers material across several applications, saves related items under different names, revisits the same sources, and repeatedly explains the context of an ongoing project. Systems can help with these tasks, but the help itself may demand supervision. If every harmless organizational adjustment produces another decision, automation transfers work into a queue instead of removing it.

CHROMATIC asks when assistance can act without repeatedly interrupting the person while remaining accountable to them. The proposed answer depends on prior, bounded authorization. Someone may permit routine organization in a particular space and reserve external communication for an explicit decision. The system should then distinguish those cases consistently, even when both arise from the same apparent objective.

This is a demanding arrangement because digital environments change independently of the assistant. A file can be replaced, an application can lose focus, permissions can be revoked,

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or another person can edit an artifact. Continuing authorization must therefore be interpreted against the current situation. Yesterday's permission and yesterday's understanding do not establish that today's target is the same or that today's action remains within scope.

The source proposes three connected forms of assistance: maintaining the environment, responding to direct intent, and developing reusable abilities from recurring work. These are different reasons for work to arise, rather than different sources of authority. A learned trigger cannot confer a permission that an explicit request would lack. The distinction connects CHROMATIC to the broader governed autonomy thesis, while its intended relationships with other systems remain subject to the architecture account. Public review scope.

2. Observation, authority, and competence

An **observation boundary** determines what the system may perceive and retain. A **standing grant** is a continuing, scoped, revocable authorization for permitted work. **Competence evidence** concerns whether a particular behavior is reliable enough to be useful. These concepts answer different questions and should remain separately understandable to the person.

Permission to read a folder may support search without permitting relocation. Permission to prepare a draft may leave sending outside scope. A successful rehearsal may justify confidence in an ability without granting access to a new account. Conversely, a broad authorization does not establish that the system understands the task well enough to perform it correctly.

This separation makes authority relevant to every form of assistance. Environmental change can explain why work is timely; it cannot authorize the work. Repetition can support a hypothesis about a useful routine; it cannot establish the person's continuing preference. Content can inform a decision; it cannot elevate itself into an instruction merely by addressing the assistant.

The reasoning system consequently occupies a limited role. It interprets context and proposes useful work, while an independent authority boundary determines whether the proposed effect is permitted. Choosing a more capable model can improve interpretation, but should not silently change the user's permissions. A model's confidence is evidence about its own assessment, not evidence of authorization.

Enforcing resource and action boundaries can prevent particular unauthorized effects. It does not prove that misleading content cannot cause a poor choice among permitted actions. A system can remain within its authority and still organize the wrong material, produce an inaccurate draft, or misunderstand a preference. Correct scope and correct judgment are both necessary, and their evidence differs. Public review scope.

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3. Maintaining a world people can still recognize

Environmental maintenance should improve access without forcing people to reconstruct their habits. A useful system can group materials by project or purpose while leaving their ordinary locations intact. This preserves compatibility with existing applications and with the person's expectations about where work resides.

The distinction between organizing a view and changing the underlying object is central. A document may be relevant to several projects without needing several physical copies. A collection can help a person find it in each context. Physical changes create additional obligations: existing references may become stale, shared workflows may depend on a location, and a later restoration may conflict with work performed since the change.

Findability also extends across time. People often remember an earlier name or the purpose of a document more readily than its current location. CHROMATIC treats continuity of recognition as a design objective: authorized organizational changes should not make an item unintelligible or unreachable to the person. Whether that objective can be met for a particular application, storage system, or external link requires platform-specific evidence.

Maintenance cannot assume complete observation. A device may sleep, a source may become unavailable, or an application may present only a partial account of change. In those situations, apparent inactivity is not evidence that nothing happened. Useful recovery must re-establish an adequate understanding before consequential work continues.

The source also seeks recoverable removal rather than silent permanent deletion. This is a conditional commitment, since recovery depends on retained information, the current state of the destination, and continuing permission. Describing a change as reversible requires evidence of a usable reversal path, not just an interface label. Public review scope.

4. Expressing intent without accidental commitment

Direct interaction introduces a different ambiguity. Spoken or typed language can be intended as content, as a request to transform content, or as an instruction to cause an external effect. “Reply that the revised draft is ready” can mean preparing words or sending them. Those interpretations differ materially even when the generated text is identical.

CHROMATIC distinguishes the preparation and insertion of text from consequential execution. Drafting an email does not itself authorize sending it. Preparing command text does not authorize running it. Transforming a thought into a useful instruction does not authorize another system to carry out the instruction. The person should be able to speak naturally without inadvertently crossing those boundaries.

The destination also matters. A person may begin dictating into one field and then switch applications before the result is ready. A safe interpretation of the initial request does not make the new field an authorized destination. Target currentness is therefore part of correctness: the intended content must reach the intended place under the intended permission.

Uncertainty should be resolved in terms the person can act on. If a destination is unavailable, the prepared text may remain available for review or deliberate retargeting. If

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the words are unclear, the person can correct them. If a consequential action needs a decision, the system should identify that decision without treating a routine transcription problem as a request for wider authority.

Privacy requirements follow the information involved. Audio, selected text, surrounding context, and previous clipboard contents are separate data sources. Needing one does not justify collecting all of them. **Local-first** is a stated placement and routing commitment for this proposal: routine perception and reasoning remain on the person's machine; movement beyond the machine is governed by the observation boundary and model policy. It does not promise that every chosen model or speech service operates offline. The information supplied to a remote stage and the conditions for its use remain independently controlled.

Stage	Intended locality and information boundary
Observation and capture	Capture occurs on the person's device within permitted surfaces. Raw audio is held in memory by default and discarded after processing; retention requires explicit policy and a visible indication. Background capture separately requires explicit opt-in.
Transcription	Local recognition is preferred when available and permitted. Provider recognition is allowed only under the applicable policy with a visible remote-processing indication. Availability, language, hardware, and offline conditions affect the selected route.
Normalization and transformation	Routine processing follows the local commitment. A chosen remote model may receive only the context permitted by the observation boundary, sensitivity restrictions, and model policy; a useful transform does not widen that information scope.
Retained records and models of work	Observation, identity, organizational views, work history, and action records have retention, isolation, and locality requirements. Actual storage placement must be identified and verified for each deployment; a local interface alone does not establish local persistence.
Later learning and reuse	Learning operates on eligible, minimized observations. Moving a result to another model, service, tenant, or audience requires the applicable scope and disclosure conditions at that use; earlier capture permission is insufficient.

This account gives remote processing a positive condition: it must be an available, policy-permitted route whose input and retention remain within the granted information scope. If those conditions are absent, the task must use an eligible local route or retain the prepared work until its actual external requirement can be resolved. Prior clipboard contents are excluded from model context and receipts. Sensitive field handling, revocation, cancellation, and network observation require platform-specific verification. The source's local-first design is therefore assessable stage by stage, rather than inferred from the location of the visible application. Public review scope.

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5. Learning useful work without learning authority

Recurring work can reveal opportunities for assistance. Repeatedly gathering the same kind of material may suggest a reusable collection. Correcting the same phrasing may suggest a preference. Repeating a stable preparation task may suggest an ability worth evaluating. CHROMATIC treats these observations as support for a candidate, not as a mandate to execute it.

The distinction is particularly important because observed behavior is incomplete evidence of intention. A person may follow a process because of a temporary constraint, make a one-time exception, or stop halfway through a task. A pattern that looks stable in recorded history may reflect selection bias. Successful imitation of past actions can reproduce an earlier mistake as readily as a useful habit.

The source proposes evaluating new abilities without affecting live work and then monitoring their behavior over time. Such evaluation can reveal obvious mismatches, but it is not equivalent to demonstrating future reliability. The available history may omit difficult cases; the environment may change; and the person's needs may evolve. A useful ability therefore needs a way to lose eligibility when its supporting conditions no longer hold.

Learning should also remain distinguishable from personal assessment. The source limits its subject to work structure and the person's digital environment, excluding psychological judgments, diligence assessments, personal value, and productivity rankings. Even operational observations can be sensitive, so this exclusion does not remove the need for minimization, retention limits, and understandable controls.

A person must be able to correct or retire an ability without arguing with an inferred preference. A rejection is evidence that the proposed assistance is unwanted in its present form. Repeatedly resurfacing the same rejected behavior can itself become a source of friction.

Evaluation of learned behavior has two distinct decisions: whether evidence supports the ability, and whether a person needs to make an additional decision before it is used unattended. A behavior can be evaluated without a live effect and then become eligible for use within a standing grant. Eligibility supplies no new authority; every later effect still undergoes the applicable scope, target, and policy checks.

The source's general evaluation rule requires a new ability to be tested against permitted historical work before unattended use. It also describes an exception for routine, deterministic, evidently reversible behavior that may omit that evaluation ramp. These descriptions support different coverage claims. Determinism means that the behavior is reproducible under fixed inputs; it does not establish that the selected target, interpretation, or outcome is appropriate. Reversibility concerns recovery from an effect; it does not establish the value of performing it.

For an evaluation claim to cover the exception, its declared policy must identify which routine behaviors qualify, what establishes their correctness and reversal path, and which changes end that eligibility. Under a policy requiring historical evaluation for every new ability, all such abilities must carry that evidence. Under a policy permitting the narrow exception, coverage must identify the excepted behaviors and their alternative basis. The

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two policies cannot jointly support a claim that all new abilities underwent historical evaluation. Neither policy permits a learned pattern, deterministic operation, or confidence score to bypass authority.

There is a narrower decision exception that does preserve evaluation: a routine ability may progress to unattended use without an additional person-facing decision after it meets the applicable evidence criteria. That is different from omitting evaluation. Consequential or ambiguous behavior has a separate decision requirement, and every consequential external run retains per-action governance even after an ability has proved useful. Public review scope.

6. Worked conceptual scenarios

Four hypothetical scenarios examine organization, observation limits, interrupted changes, and learned drafting.

Illustration 1 — useful organization within a limited grant. A researcher permits organizational views over a project folder and allows the assistant to read ordinary project documents. Several materials concern the same upcoming review. The assistant brings them together in a useful collection while preserving the underlying files. The researcher can still open each document through the familiar application and can remove an incorrect association. Success requires that the collection contain the intended material and remain within the observation boundary. A plausible title alone would not establish success.

Illustration 2 — a relevant item outside the observation boundary. While working on the collection, the assistant encounters a reference to a restricted personnel folder. The referenced material might improve the collection, but relevance does not supply permission to inspect it. The assistant can complete the authorized portion using available material, while making any material limitation clear when it affects the result. It cannot search an alternative location for the same protected content as a way around the restriction. The scenario illustrates a scope boundary, not a claim that every possible indirect disclosure channel has been eliminated.

Illustration 3 — an uncertain organizational change. A previously authorized local change is interrupted before its outcome is confirmed. Repeating the change immediately might duplicate work or act on a replacement object. Recovery must determine what actually happened and whether further work remains appropriate. If the original effect occurred, the account should reflect that effect. If a corrective action is needed, its current feasibility and permission must be established. Merely displaying an error would not complete the objective, and missing confirmation would not prove that nothing changed.

Illustration 4 — a learned draft with an external boundary. A consultant repeatedly prepares a weekly status note from authorized project sources. A candidate ability is evaluated against prior examples and becomes useful for drafting. The consultant later changes the recipients and includes a sensitive topic. The ability's prior success does not establish that the new audience may receive the content, nor does draft permission authorize transmission. The assistant can prepare suitable material within scope and resolve the external decision separately. If the changed task no longer matches the evaluated behavior, earlier competence evidence should carry less weight.

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These examples show why useful autonomy requires several kinds of success at once: relevant assistance, correct target, current authority, appropriate disclosure, and observed outcome. No single confidence score or activity record establishes all five.

7. Accountability and its limits

Quiet operation depends on the person being able to discover what happened without having to supervise every step. An activity account should connect an action to its subject, reason, and observed result. It should also distinguish a completed change from a proposal, an interruption, and a correction. An attractive history view cannot substitute for evidence about the underlying effect.

The recording requirement follows the actual consequence class. The following table separates competence evaluation, authority, and the durable action account. Its descriptions are conceptual categories from the source, not an implementation schema.

Behavior class and examples	Evaluation and authorization	Action recording and recovery
Ephemeral processing: permitted observation, local transcription, an in-memory draft or temporary overlay	Observation remains within its independent boundary. No persistent or external effect is implied.	No durable action receipt is required for the ephemeral processing class. Retaining a transcript or creating a file changes the consequence and requires the corresponding conditions.
Reversible local presentation: a label, virtual collection, surfaced item, clipboard insertion, or draft text	A standing grant covers the presentation effect. A newly learned behavior also follows its declared evaluation policy.	The action receipt is policy-dependent. A claim of reversal requires a verified path; clipboard and target changes must be considered. This class cannot support universal durable action coverage.
Reversible local object creation: a workspace draft or a proposal for another store	A standing grant covers creation; the receiving store retains authority over adoption. Learned competence is assessed separately.	A receipt is required for creation. Creating a proposal does not establish that another authority adopted it.
Reversible local mutation: moving, renaming, setting aside, or restoring an item in a managed space	A scope-specific standing grant, current target, and applicable policy govern the effect.	A receipt and reversal record are required. Recovery depends on retained information, the current object, and continuing authority.
Consequential or external work: sending, publication, external writes, shell execution, or desktop automation	Each action requires its applicable governance decision, even within a standing grant. Learned eligibility cannot supply this permission.	A receipt is required. An irreversible effect must be identified as such; compensation is separately authorized work.
Restricted or protected work	The active protected boundary blocks the action. Any permitted scope change requires separate responsible authority; an alternate route cannot evade the boundary.	Policy and audit requirements govern the decision account. No authorized effect follows merely from the importance of the objective.

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These distinctions support accountable quiet work without claiming that every event has the same durable record or reversal guarantee. Governance decisions and required action outcomes have their own record duties; a policy-dependent local presentation receipt does not erase them. An action that may already have occurred requires observation and reconciliation when its required result record is missing. Missing evidence cannot be treated as evidence of non-occurrence, and immediate repetition may duplicate the effect.

The scope of a history claim must consequently identify its included classes and the recording policy for local presentation. A history derived from receipts cannot be presumed to include ephemeral processing or every presentation change. Recording a decision, recording an effect, and reconstructing the surrounding world are separate achievements. Compensation may reduce the consequences of an action, but sending a correction does not erase an earlier disclosure.

Historical reconstruction has similar limits. A record of the assistant's actions is not automatically a complete record of the world. Other applications and people may act independently, and retention may expire. A reconstruction claim therefore needs a defined scope, sufficient observations, and a way to represent uncertainty. An activity interface alone cannot establish a comprehensive history.

Revocation also operates in time. It should prevent future work that lacks authority, while an effect already delivered to an external party may remain beyond recall. Explaining that difference is necessary for meaningful control. The shared evidence guide distinguishes specified behavior, observed execution, and stronger assurance claims. Public review scope.

8. Research status, relationships, and evaluation

CHROMATIC is a proposed system. Dated alignment observations and implementation plans describe its relationship to earlier repository states; they do not establish current product behavior. The acceptance criteria define the demonstrations needed to assess implementation.

The source explicitly intends CHROMATIC to use existing authority, model, observation, and accountability owners rather than establish competing control systems. It also identifies unresolved integration questions. These are proposed relationships whose realization requires separate evidence. Similar concerns appear in other papers in this collection, including environment continuity and governed learning; conceptual resemblance does not establish interface compatibility, formal refinement, or implemented adoption.

Evaluation should measure usefulness and control together. A system that avoids every risk by doing nothing would not establish useful assistance. A system that completes many tasks while exceeding scope would not establish governed assistance. Suitable studies would include ordinary authorized work, ambiguous intent, restricted material, changed targets, interrupted effects, revoked permissions, and changes in the environment after an ability was evaluated.

Several questions remain open. How much review effort does quiet assistance actually remove? Can people understand and maintain observation and action permissions over time? How reliably can the system recognize that a learned routine no longer fits? Which

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organizational changes preserve compatibility with existing applications? How should incomplete history be communicated without overwhelming the person? What evidence is sufficient before offering a reversal? These questions require operational and human evaluation beyond the source specification.

The research proposition is that ambient usefulness and continuing human authority can be designed together. Establishing it requires measured task outcomes and demonstrated boundaries across realistic conditions. The glossary relates this paper's terminology to the rest of the collection.

Source guide

This successor guide points to public arguments and their limits. The new private evidence linkage remains excluded. Previously public conceptual source guides, including any retained titles, document ordinals, sections and chapter maps, are not claimed to have been removed; see the correction scope. The historical edition remains available unchanged.

Purpose. Review the relevant argument and assumptions in this paper, the evidence guide, and the research review route. Specification, reported results and production observations have distinct scope.

Authority and observation. Review the relevant argument and assumptions in this paper, the evidence guide, and the research review route. Specification, reported results and production observations have distinct scope.

Environmental maintenance. Review the relevant argument and assumptions in this paper, the evidence guide, and the research review route. Specification, reported results and production observations have distinct scope.

Direct intent and locality. Review the relevant argument and assumptions in this paper, the evidence guide, and the research review route. Specification, reported results and production observations have distinct scope.

Learning. Review the relevant argument and assumptions in this paper, the evidence guide, and the research review route. Specification, reported results and production observations have distinct scope.

Evidence and integration. Review the relevant argument and assumptions in this paper, the evidence guide, and the research review route. Specification, reported results and production observations have distinct scope.

No source-guide entry establishes a full implementation, a complete historical migration proof, or an independent audit.

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