Nothing succeeds like success: A framework for evaluating digital preservation efficacy

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Abstract

Digital preservation encompasses the theory and practice ensuring purposeful use of digital resources over time. But how can one tell whether it has been effective or not? The evaluation of preservation efficacy has two dimensions: *trustworthiness* of managerial programs and systems, and *successful* use of managed resources. The former has received extensive attention, while the latter has been little investigated. This stems from an insufficiently broad and nuanced conceptualization of the preservation enterprise, which should be viewed more expansively as facilitating meaningful human communication across time and concomitant cultural distance. Communicological analysis leads to a semiotic-phenomenological model for preservation-enabled communication cognizant of the elusive nature of use, which is inherently contingent with respect to time, place, person, and purpose. Preservation success is positioned as an individual, rather than universal value, with a benchmark evaluation of situational verisimilitude, rather than absolute fidelity to an illusory canonical state and information experience. The proposed evaluative framework offers greater conceptual clarity to preservation theory and practice, a more rigorous basis for illuminating the limits of preservation efficacy, and a more nuanced means of stating, measuring, and evaluating preservation intentions, expectations, and outcomes.

Keywords

Digital preservation, efficacy, trustworthiness, success, communicology, semiotics, phenomenology

1 Introduction

Digital preservation encompasses the theory and practice aimed at ensuring ongoing access to and purposeful use of digital resources into the indefinite future. Preservation strategies can take a variety of forms resulting in a broad range of outcomes. For example, an attempt to satisfy a future request for a previously preserved resource could variously take the form of providing:

- Original physical media holding the resource (say, a magnetic tape);
- Contemporary media holding the resource (USB drive);
- A file, about which nothing more is known;
- File in original known format (WordPerfect);
- Derivative file of known format (PDF);
- File and rendering software (Acrobat Reader);
- File and provenance (PREMIS metadata);
- File and token of authenticity (PKI signature);
- File and intellectual description (MARC record);
- File and productive context (DataCite methodology statement);
- File and curatorial context (EAD finding aid);
- File and prior consumptive context (published article citing the resource);

and so on. At what point can one say that the preservation outcome was successful? Without knowing, how can one rationally plan for, reasonably expect, effectively measure, or meaningfully be held accountable for that outcome?

In 2006 Lynch observed that digital preservation is "a metric that's defied measuring" [1], and little progress has been made since then identifying appropriate metrics for quantifying preservation success. This stems from an unduly narrow conceptualization of the preservation field as synonymous with preservation *management*. The focal point of that management is conformance to the ISO 14721 OAIS reference model [2, 3], and its accepted evaluative metric is trustworthiness relative to ISO 16363 TDR audit and certification criteria [4, 5]. TDR criterion 4.3.4 mandates that a trustworthy repository "provide evidence of the effectiveness of its preservation activities" [6], but the literature provides little direction as to what form that evidence might take. Regardless, a true understanding of preservation efficacy is ultimately a question of evaluating consumer-experienced *outcomes*, not just managerial trustworthiness. The basis of that evaluation is how well the outcomes align (or misalign) with productive and managerial intentions and consumer expectations and exploitive purposes (see Figure 1).

However, the preservation field has not yet matured to a point of having established metrics for evaluating the success (or failure) of its outcomes [7, 8], nor has it developed sufficiently robust theoretical models [9] to underpin any such evaluation. Tangible progress towards measurable metrics is dependent upon re-defining the preservation domain on a more expansive, nuanced, and conceptually-sound basis [10]. Rather than focusing exclusively on methodological approaches to the question of the trustworthiness of its managerial subdomain, the preservation community also should be asking what theoretically-informed measures can and should be used to evaluate the success of the digital preservation enterprise.

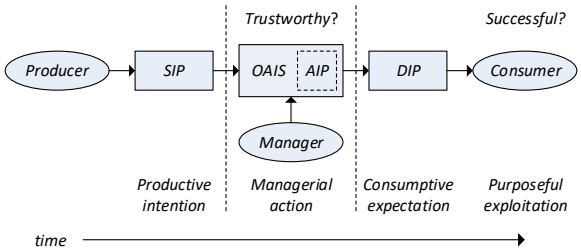

Figure 1: Trustworthy vs. successful measures

2 Re-conceptualizing the preservation domain

Within the literature, the focal definition of the digital preservation field revolves around custodial stewardship by archival institutions [3, 11, 12], most often expressed in terms of appropriate data management activities, e.g., [13-15]. At the center of that management is preservation instrumentality provided by OAIS systems, with controlling responsibility resting with OAIS managers. This emphasis on managerial agency and action, e.g., [16, 17], minimizes opportunities for appropriate consideration of pre-acquisition or post-retrieval activities and the concomitant experiences of information producers and consumers [18, 19], even though the ultimate goal of preservation – the future use of preserved resources – is inseparable from their perspectives [20, 21]. Explicit consideration of producers and consumers reframes the preservation imperative to a transfer of information from one to the other, or in other words, mediated human communication. This is consistent with an alternative formulation of the domain as a means of "communicating with the future" [22-24]. However, while these authors deploy the *metaphor* of communication, they do not follow through on its consequences to redefine the field fundamentally in communicological terms or rely upon communicological analyses. Communicology is the science of embodied discourse [25], with theoretical and methodological foci on the semiotic affordances of communicated messages and phenomenological experiences of communicating actors [26].

Communicative processes have been analyzed from a variety of perspectives, including the propagation of signals independent of interpretation, as well as the subjective experience of human participants [27]; the degree to which a common field of experience underlies the interpretation of messages, and the alignment of intent and consequence as reflected in the effect messages have upon their receivers [28]; the psychological and anthropological implications of communication across a hierarchy of intrapersonal, interpersonal, group, and cultural structures [27]; and the context of expressive and interpretive coding/decoding strategies, and the real or conceivable external referents of communicated epistemic meaning [26]. These various aspects can be aligned and compared by reference to a formally-defined semiotic meta-model [29], which provides a compelling framework for such meta-analysis.

Semiotics is the study of signs and systems of signification, that is to say, things that somehow *carry* communicable meaning or affect, and the ways in which they are expressed, exchanged, and experienced [30]. The semiotic affordances propounded by Peirce are threefold: abstract meaning, expressive form, and interpretive understanding, the latter of which concretizes in relation to some situated context [31]. The antecedents of Peircean semiotics reach back to scholastic and classical philosophy [32, 33], which assumed purely analog sign transmission, e.g., spoken words, inscribed stone, ink on paper, paint on canvas, etc. The advent of the digital age necessitated the augmentation of semiotic concerns for greater applicability to digitally-mediated communication. These extensions include distinguishing a sign's abstract expressive form from its concrete symbolic representation and tangible manifestation [34]. Other aspects of digital communication warranting entry into the semiotic canon include the performative behavior producing humanly perceptible form [35, 36], assessment of archival and informational integrity and authenticity [9], and the manifold ways in which digital information can, should, or must evolve over time to ensure ongoing accessibility and usability [37, 38]. The full complement of these analytic strategies and semiotic concerns has not previously been integrated into a unified model applicable to the digital preservation domain.

The practice in that domain, moreover, does not rest on firm theoretical foundations [3, 39, 40]. Claims of theoretical advance often deploy the term "theory" in a narrow sense of a proposed thesis or pragmatic solution, e.g., [23, 41]. Others conform to the more expansive notion of a coherent system of abstraction, explanation, and inference, but rely upon logical and mathematical formalisms tacitly assuming that preserved resources fully encapsulate the knowledge-states of their producers, and that those states can be unambiguously (re)experienced by consumers, e.g., [37, 38, 42]. This position is at odds with the post-modernist view of the essential contingency of human communication and epistemic behavior [43, 44], which implies that any use of a preserved resource is inherently situated with respect to time, place, person, and purpose. Thus, the theoretical and methodological constructs of communicology – the cultural semiotics of information expression and reception [45], and the embodied phenomenology of information experience [46] – are an appropriate basis for a re-conceptualization of the digital preservation field.

There are many contemporary forms of digitally-enabled communication, e.g., email, text, telephony, streaming video, social media, etc. How can digital preservation be distinguished meaningfully from these alternatives? The primary differentiating characteristic is preservation's focal attention to the potentially corrosive impact of time. The communicological literature does not address this temporal concern; instead, communication is tacitly assumed synchronous in time. Conversely, while the preservation

literature is strongly focused on temporal consequences, it does not incorporate communicological perspectives. Melding these two philosophical and methodological traditions provides a richer set of analytic tools applicable to the question of preservation efficacy.

3 Modeling preservation communication

Communicological analysis of the preservation domain has three stages: (1) process modeling of preservation-enabled communication; (2) identification of pertinent semiotic affordances of modeled resources and processes; and (3) derivation of appropriate measures of the phenomenological experience of modeled actors. A proper model for digital preservation should be grounded in a conceptualization of its problem domain as human *communication* rather than data management; emphasizing the consequences of digital communication across *time* and concomitant technical and cultural distance; analyzing the entire post-custodial *enterprise*, not just the subdomain of custodial management; promoting the primary value of *success* alongside trustworthiness; evaluating success through *operational*, not just descriptive evidence; and placing *theoretical* concerns on equal par with pragmatic ones, providing opportunity for consideration of the situated contingency of preservation-enabled communication [10].

The goal of that communication is to transfer intangible but intentional cognitive meaning or affect, which is an internal epistemic state of the producer arising in a particular situated context and referencing some real or conceivable external entity or idea, to a consumer across temporal, technical, and cultural distance (see Figure 2). A complementary process follows reception of the perceptual form of a rendered resource: new epistemic understanding arising in a consumptive context relative to an interpretive referent. Considerations of trustworthiness are pertinent only to mediating curatorial actions and their consequences regarding the integrity and authenticity of a resource's dynamic state. The measures of success are twofold: a secondary consideration of equivalence between intentional and interpretive meanings/understandings and their underlying referents; and a primary consideration of fulfilment of consumptive purpose.

The workings of this model can be illustrated thus: this paper originated as an idea regarding measurement of preservation efficacy on the part of the author (its intentional meaning) with respect to an ur-notion of preservation success (intentional referent) and reflective of the author's accumulated professional experience and acculturation (productive context). That idea was expressed in terms of a scholarly paper with abstract, literature review, citations, etc. (expressive form), encoded in Word Office Open XML (symbolic representation), saved in the file "Abrams-iPRES-2018.docx" (tangible manifestation), and accompanied by salient description of its informational content and function as a container (inner and outer description). Subject to proactive preservation management (curatorial context) the file was transformed (curatorial intervention) into "Abrams-iPRES-2018.pdf" (tangible manifestation) with PDF encoding (symbolic representation) but equivalent expression (curatorial authenticity) as a scholarly paper (expressive form) and underlying idea (intentional meaning). The PDF can be rendered with Acrobat Reader (revealing behavior) into a readable document (perceptual form), which, ideally, instigates a state of newly acquired consumer knowledge (interpretive understanding), conditioned with respect to that consumer's experience, acculturation, response to the author's reputation, and imprimatur of peer review and presentation venue (consumptive context). The reading is successful if it fulfils the consumer's expectation for purposeful use: a new understanding of preservation efficacy informed by recovered productive intent.

Each component of the model supports its own set of productive, managerial, and consumptive affordances, for which specific metrics and criteria can be derived. Any given instance or category of use will entail a characteristic subset of those affordances and be susceptible to their associated metrics. Impediments to success can arise at each point of transition between model components [26], which suggests that success measures need to apply not only to the static configuration of the component entities, but also their dynamic unfolding through iterative preservation interventions across archival timespans.

4 Preliminary findings and next steps

Like any formal discipline, digital preservation should be viewed as a complex of actors, policies, technologies, and practices [30, 47]; the maturity of the discipline is dependent upon its capacity for reflective evaluation [48]. There are two primary assessments of preservation efficacy: *trustworthiness* of managerial systems and programs; and *successful* use of managed resources. The property of trustworthiness is properly associated with processes and actors *leading* to preservation outcomes, but not the outcomes themselves [49]. The focal attention heretofore given to trustworthiness is not misplaced, but is insufficient for a true measure of preservation efficacy. The measure of success complements and validates prior designations of trustworthiness through consideration of the operational actuality of outcomes alongside the descriptive potentiality of trustworthy managerial systems.

Because of the open-ended time horizon of preservation commitments, preservation success should be understood properly as a *conditional*, rather than absolute value. One can't make categorical assertions beyond the ever-forward-moving point of now, since the consequences of even the immediate the future cannot be fully anticipated [50]. This bears similarity to the concept of scientific falsification under which a theory is held to be provisionally true so long as it has not been proven definitively false [51]; so too it is legitimate to assert the success of digital preservation *so far*. The temporal distance that is the primary impediment to that

success necessarily implies concomitant cultural distance [52] and culturally-situated contingency. Thus, success should be evaluated according to a standard of situational *verisimilitude*, rather than universal fidelity to some illusory notion of canonical state and information experience. This bears similarity to the concept of scientific truthlikeness under which the truth of a theory ranges along a spectrum of plausibility [53]; so too it is legitimate to evaluate success as the *relative* degree to which preserved resources can be purposefully exploited.

Semiotic-phenomenological modeling of preservation-enabled communication and consequent identification of semiotic affordances supported by model components will be further refined through Conceptual Framework Analysis (CFA) [54] for more detailed representation of the complexity and nuance of the preservation domain than the previous Sept model [30]. In particular, public preservation policy statements [55] will be subject to close content analysis [56, 57] to surface ambiguities, assumptions, and service level obligations that define intentions, constrain actions, and set expectations. Subsequent to that, effort will turn to the last stage of communicological analysis, the derivation of specific criteria and metrics for evaluating digital preservation efficacy and success.

5 Conclusion

Digital information is indispensable to contemporary commerce, culture, science, education, and entertainment. No future understanding of a prior time in the digital age is possible without proactive preservation of our digital heritage. A communicological model of the semiotic and phenomenological affordances of the digital preservation enterprise provides a better means to analyze, explicate, and understand the domain. The model is consistent with, but extends OAIS-defined structures for richer representation and broader applicability. It can be used to derive criteria and metrics for evaluating success in a manner cognizant of post-custodial context and post-modernist contingency. The availability of conceptually-sound yet operationally-feasible measures offers scholars new insights into the theory, practice, and limits of efficacy of the enterprise. An evaluation rubric based upon those measures will provide practitioners with the means to assert meaningful nuanced distinctions regarding intentions, expectations, and outcomes in a concise yet precise manner. It also can form the basis for rational prioritization of strategic goals, allocation of programmatic resources, and transparent accountability to stakeholder communities.

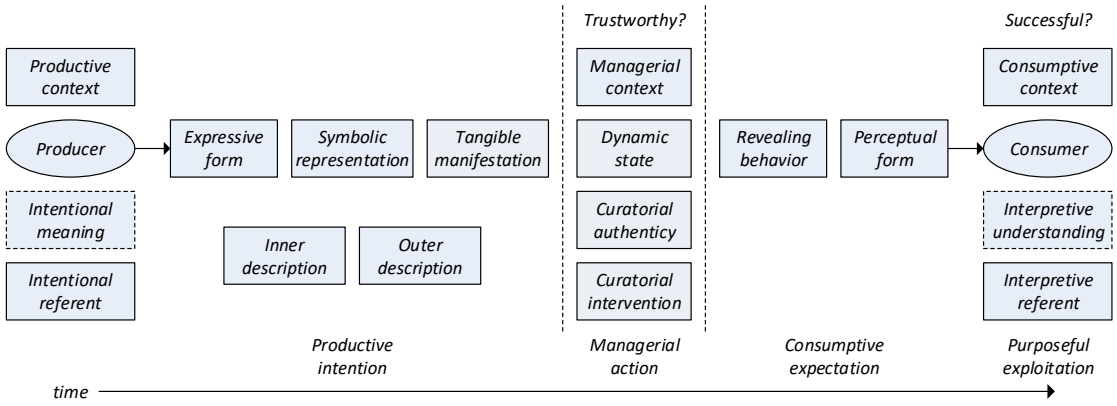

Figure 2: Preservation-enabled communication

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