



Bridging theory and practice: affordance theory as a methodological link in information interaction and repository design

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Abstract

Introduction. Information practices research and information systems design remain disconnected despite their complementary aims. Affordance theory offers a methodological bridge by translating cognitive-contextual insights about user interaction into actionable design specifications for repository systems requiring culturally appropriate, context sensitive governance.

Method. I integrate Ingwersen and Järvelin's information interaction model with Pozzi et al.'s affordance process framework, adapting it to explicitly incorporate signifiers and decision-making stages. This integration maps user cognitive space, task contexts, and interface functionalities to affordance perception, actualisation drivers, and design specifications.

Analysis. The adapted model provides systematic translation between user cognition and system features, enabling diagnosis of implementation gaps where governance capabilities exist but remain hidden or un-actualised due to inadequate signification or institutional constraints.

Results. Using Indigenous data territorialisation as an illustrative context, the framework reveals hidden and false affordances, specifies governance-relevant signifier and decision points, and produces actionable repository design requirements for context-sensitive governance.

Conclusion. Affordance theory systematically converts information interaction insights into repository design specifications, bridging the theory-practice gap through relational analysis that makes contextual governance requirements analysable and designable across diverse cultural settings.

Introduction

There has been a longstanding disconnect between information practices research and information systems design (Fidel, 2012; Haider & Sundin, 2019; Huvila et al., 2022; Ingwersen & Järvelin, 2005; Julien, Pecoskie & Reed, 2011; Julien & O'Brien, 2014). This gap persists even though systems designers acknowledge the need for deeper insight into user needs (Leitch & Warren, 2010) and information practices, with its human-centred focus on digital information environments, is well positioned to provide it (Bates, 1986). A key reason is a mismatch in emphasis: information practices often treats information technology artefacts as secondary to people and practices, while fields such as human-computer interaction and information systems design centre technological artefacts (Buckland, 1991; Gorichanaz & Venkatagiri, 2021). As a result, information practices frequently produce rich, contextual understandings that prioritise explanation over operational guidance, making translation into concrete system requirements difficult. Responding to this challenge, scholars have urged information behaviour practice to frame findings in ways that more directly support practice, including systems design (Huvila et al., 2022).

Affordance theory offers a practical bridge across this theory-practice gap. Affordance theory translates insights from information interaction models into actionable repository design by mapping user cognition and context to perceived/actualised actions to concrete features, signifiers, and governance outcomes. By conceptualising affordances as relational properties that arise from the interaction of user capabilities and system features, it provides an analytical and translational vocabulary for turning insights about information practices into actionable design guidance.

This paper demonstrates how affordance theory can serve as that bridge by integrating information interaction models with repository design practice. First, I explore Ingwersen and Jarvelin's (2005) information interaction model showing how users' cognitive structures, contextual knowledge, and situated perceptions shape engagement with repository systems. Building on this foundation, I then position affordance theory as the translational mechanism that converts understanding of information practices into systematic design guidance. Lastly, I use our adapted affordance process model that explicitly incorporates signification and decision-making to show how sovereignty-respecting features can be embedded within repository architectures and evaluated in practice. I use examples from Indigenous data territorialisation contexts where sovereignty-respecting governance creates particularly complex requirements, to demonstrate how the affordance-based approach can be applied to a repository system requiring culturally appropriate, context-sensitive governance practices. The outcome is an adapted, stage-based diagnostic that yields implementable design specifications (features + signifiers + decision points).

Indigenous data sovereignty and data territorialisation

This paper uses Indigenous data territorialisation as an illustrative example to demonstrate how affordance theory can translate information interaction insights into concrete repository design guidance. Since this context may be unfamiliar to some readers, I briefly introduce the core concepts that underpin its relevance for information systems design.

Indigenous data sovereignty refers to the rights of Indigenous peoples to govern the collection, ownership, access, use, and reuse of data that relate to them, their communities, cultures, lands, and knowledge systems. These rights are grounded in Indigenous self-determination and collective governance traditions, and they challenge dominant research data practices that treat data as universally shareable resources detached from social and cultural context (Carroll et al. 2020). In practical terms, Indigenous data sovereignty requires that data infrastructures support differentiated access, community authority, contextual decision-making, and accountability to

collective protocols—rather than relying solely on individual consent or open-by-default dissemination models.

Within this broader framework, Indigenous data territorialisation refers to governance practices that explicitly link data to place, jurisdiction, and relational responsibility. Territorialisation does not imply that data are static or confined to geographic boundaries; rather, it reflects the idea that data remain socially and culturally situated, even when digitised and shared. Territorial actions may include restricting access based on community authority, signalling provenance and jurisdictional relationships, embedding cultural protocols within metadata, or structuring discovery interfaces around place-based logics rather than abstract classification schemes. These actions require users to make governance decisions during information interaction—decisions that are often invisible or unsupported in conventional repository systems.

Repository environments provide a particularly instructive setting for examining these issues because they are designed to mediate between diverse users, institutional policies, and technical infrastructures. Many contemporary repositories already possess technical capabilities that could support context-sensitive governance—such as access controls, metadata customisation, or differentiated user roles—but these capabilities are frequently underutilised or misunderstood. In Indigenous data sovereignty contexts, the consequences of such gaps are especially visible: governance features may exist but remain hidden due to inadequate signification, misaligned workflows, or institutional constraints that discourage their use.

For this reason, Indigenous data territorialisation serves in this paper not as a specialised or exceptional case, but as a diagnostic lens. The complexity of cross-cultural signification, collective authority, and contextual decision-making foregrounds precisely the kinds of translation problems that affordance theory is well suited to address. By examining how users perceive, decide upon, and actualise governance-related affordances in this setting, I can more clearly demonstrate how information interaction models and affordance process models can be integrated to produce actionable design specifications. While the example is grounded in Indigenous governance contexts, the analytical approach applies broadly to any repository system that must support culturally appropriate, context-sensitive, or differentiated governance practices.

Information interaction as a foundational lens

Sociotechnical approach to information systems

Our approach draws on critical data studies and sociotechnical systems, which offer both an analytic lens and a design orientation. Sociotechnical systems hold that technologies cannot be understood apart from the social and technical relations that shape them and their users—a fundamentally relational view (Fox, 1995). This stance explicitly counters ‘data universalism’ and related forms of technological determinism that strip away cultural specificity and context (Milan & Tréré, 2019).

Within this lens, policy, education, and infrastructure work in concert to support data ethics across diverse governance contexts. Policy and law regulate; education builds capacity; and infrastructure mediates practice through affordances and constraints. Our focus is the infrastructure of research data management systems—examined in relation to policy, education, and research culture. Because repositories do not operate in isolation, I use an information interaction model to account for interface use and the social-cultural factors that shape decisions. This model aligns with Pozzi et al.’s (2014) affordance framework, which I adopt as a translational mechanism linking interaction insights to concrete repository design.

Information interaction

To move from a high-level sociotechnical view to the lived experience of repository use, I adopt Ingwersen and Järvelin’s (2005) information interaction model. The model foregrounds three

foundations: 1) a cognitive-contextual stance in which meaning and relevance are constructed by users within layered social and organisational settings (Ingwersen & Järvelin, 2005; Marchionini, 2008; Savolainen, 2018); 2) purposive, task-oriented activity—work tasks shape information needs and drive seeking, evaluation, and use (Ingwersen & Järvelin, 2005; Wilson, 1999); and 3) polyrepresentation and nested contexts, which recognise multiple, overlapping representations of needs and objects operating across interface, system, and socio-organisational layers (Ingwersen & Järvelin, 2005).

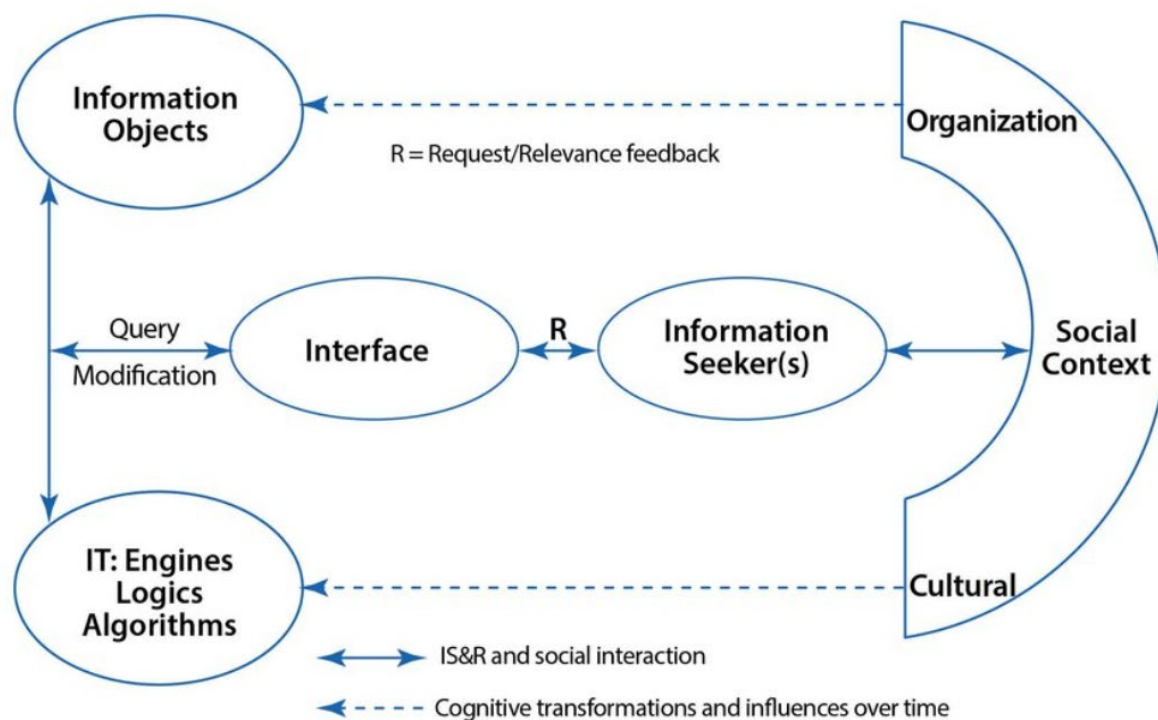


Figure 1. Integrated model of information seeking and retrieval. Simplified model, based on Ingwersen and Järvelin, 2005 (Saracevic, 2017).

Structurally, the model organises interaction around five interrelated components: information objects (knowledge representations), information technology infrastructure (algorithms, indexing, logic), interface functionalities (the cognitive intermediary), user cognitive space (knowledge state, uncertainty, intentions), and the socio-organisational environment (domains, norms, work practices) (Ingwersen & Järvelin, 2005). This framing is deliberately relational and ecological, aligning with perspectives that situate human-information activity within broader environments of practice and technology (Fidel, 2012; Savolainen, 2018; Marchionini, 2008).

These same foundations provide natural bridging points to affordance theory. Perception, intention, and context in the interaction model map directly onto affordances understood as relational action possibilities contingent on user capabilities and system features; interface functionalities become the locus for signifiers that make affordances perceivable; and task-driven interaction supplies the decision points where affordances are—or are not—actualised. Accordingly, I integrate Pozzi et al.'s (2014) affordance framework to translate interaction insights into concrete repository design: I treat a) cognitive/perceptual cues as inputs to affordance identification, b) interface elements as carriers of signification, and c) task flows as sites for decision and actualisation. These bridging points are not metaphorical—they represent systematic correspondences that enable direct translation between frameworks. As I will demonstrate in subsequent sections, perception in the interaction model maps to the perception stage in the

affordance process; intentionality maps to decision-making; interface functionalities map to signifiers; task contexts map to actualisation drivers; and cognitive space supplies the actor component that conditions all stages of the affordance process. This systematic mapping transforms affordance theory from a general concept into a precision tool for operationalising information interaction insights.

Translational power of affordance theory

Cognitive viewpoint as an epistemological bridge to affordances

The cognitive tradition in information interaction holds that meaning, relevance, and action arise through users' mental models, knowledge states, and intentions as they encounter information systems (Ingwersen & Järvelin, 2005). Cognition operates bidirectionally: designers and systems embed cognitive structures into features and algorithms, while users interpret and act through their evolving knowledge and goals (Belkin, 1990; Ingwersen, 1982). This activity unfolds within nested contexts and benefits from polyrepresentation—multiple representations of needs and objects that jointly shape perceived relevance and actionability (Ingwersen & Järvelin, 2005). This relational epistemology establishes a principled connection to affordance theory: just as information becomes meaningful through user-context relationships, affordances emerge from the fit between actor capabilities and environmental features (Pozzi et al., 2014).

This bridge becomes concrete through systematic mapping of cognitive constructs to affordance constructs. Perception aligns with affordance recognition; intentionality supplies the motivational frame selecting among possibilities; mental models condition what is perceived and feasible; polyrepresentation creates multiple potential affordances through diverse representations (metadata fields, labels, overlays); and interface functionalities provide signifiers that render affordances perceivable (Ingwersen & Järvelin, 2005; Pozzi et al., 2014).

This mapping is bidirectional: the information interaction model analyses user-side phenomena (knowledge, perception, intention), while affordance theory analyses system-side phenomena (features, signification, enablement). Together they form a complete circuit—user cognition → affordance perception → decision → actualisation → effects feeding back to cognitive space. This makes theory-to-practice translation systematic. Consider Indigenous data territorialisation as an illustration:

Integrated Component	Indigenous data territorialisation
Perception (cognitive space → affordance perception)	If users' mental models do not include territorial data governance concepts, they will not perceive repository features as affording territorial actions. Therefore, signifiers must be keyed to users' cognitive structures—labels, icons, territorial overlays, protocol badges that resonate with existing mental models or scaffold new ones through culturally appropriate signification.
Intentionality (task context → decision-making)	If users' work tasks do not explicitly include sovereignty-respecting goals, they will not actualise territorial affordances even if perceived. Therefore, workflows should surface governance decision points at moments aligned with users' task flows—e.g., scoping search by jurisdictional territory during the information-seeking task, not as a separate compliance step.
Context (socio-organisational → actualisation drivers)	If institutional policies do not support territorial governance, perceived affordances won't be actualised even if users are motivated. Therefore, viability and feasibility drivers must be designed

	into both technical systems and organisational policies—permissions, training, incentives that enable rather than obstruct sovereignty-respecting actions.
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Table 1. Mapping user factors in the effectiveness of Indigenous data territorialisation strategies using integrated components between information interaction and affordance theory.

In each case, the information interaction model diagnoses the user-side constraint (what cognitive, task, or contextual factors impede appropriate action), while affordance theory prescribes the system-side intervention (what features, signifiers, or drivers address that constraint). This bidirectional analysis makes theory actionable.

Building on the information interaction and affordance theory foundations, I integrate signifiers and decision-making into Pozzi et al.’s (2014) process model. Signifiers, drawn from interface functionalities, mediate between user cognitive space and system features to make affordances perceivable—a component the original model did not explicitly analyse. Decision-making, positioned between perception and actualisation, accounts for motivations and institutional constraints—feasibility, viability, responsibility, and desirability—that determine whether perceived affordances translate into action.

Conceptualizing affordances

Within information science, affordance theory takes a sociomaterial perspective: affordances are neither intrinsic to technology nor purely socially constructed, but emerge from dynamic interactions between users, technologies, and organisational settings (Wang et al., 2018; Mora et al., 2021). This positioning avoids both technological determinism and social constructivism, making it particularly valuable for contexts requiring culturally appropriate governance. Gibson first coined the term ‘affordance’ in 1966 within the context of the emerging field of ecological psychology but the foundational definition ‘the affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill’ (p. 127) appeared in 1979. At its core, affordance theory examines how actors perceive environments as landscapes of possibilities for action—what the environment affords to an organism. The theory has been widely adopted across psychology, engineering, education, and information systems design (Pozzi et al.’s, 2014; Wang et al., 2018).

Relational properties and action possibilities

Affordances are relational properties that exist only in the relationship between actor and environment (Chemero, 2003; Turvey, 1992). They are that which is made possible by the actor interacting with an object in their environment, not properties of the object or the object itself. For example, a metadata field alone is not an affordance; rather, the affordance is the potential action—the inputting of text by the user—that is made possible through interaction (Gaver, 1991). While affordances are relational, they are also objective in that they are measurable and can be studied empirically (Gaver, 1991; Turvey, 1992). Affordances are ‘features of whole situations’ rather than isolated properties of objects (Chemero, 2003). Understanding affordances as existing at the nexus of relations means that an actor’s ability to perceive an affordance is dependent on their cognitive space—whether or not they have the knowledge structures necessary to perceive the existence of the affordance (Rojas, 2024). Further, their decision of whether to act arises from their knowledge structures and cultural competencies.

Ethical dimensions and values

Gibson's (1966) original conception included an ethical dimension often overlooked in contemporary applications: 'I have coined this word 'affordances' as a substitute for 'values'... I mean simply what things furnish, for good or ill' (p. 285). Here Gibson is saying that what things *mean* to an organism—good, bad, useful, dangerous, inviting, prohibiting—does not originate in abstract values imposed by the mind, but in directly perceivable action possibilities in the environment. For example, a cliff affords falling, that is, danger, and a chair affords sitting, that is, rest. These are not judgments added afterward—they are directly perceivable properties of the organism–environment relationship. Affordances do the work that *values* were supposed to do, but without separating facts from meanings. This demonstrates that affordances inherently carry ethical implications (Evans et al., 2017). An affordance is not merely a single available action, but an action carrying a goal with meaning within its larger context—resonating with our information interaction lens.

From interaction model to affordance process: Translational requirements

Having established both the information interaction framework and affordance theory foundations, I now synthesise these perspectives into an integrated process model. This synthesis requires two key adaptations to Pozzi et al.'s (2014) original affordance framework: explicitly incorporating signifiers and distinguishing decision-making as a separate stage.

First, I must explicitly incorporate signifiers as a mediating layer. In the information interaction model, interface functionalities serve as the primary point of contact between user cognitive space and system infrastructure. These interface elements don't merely exist—they communicate through signifiers that make potential affordances perceivable. However, the original model treats perception as emerging directly from user-object interaction without explicitly modelling the signification mechanisms that enable or constrain perception. By adding signifiers as a distinct component attached to objects, I operationalise the interface functionalities layer from the interaction model, making signification an analysable design target rather than an implicit assumption.

Second, I must distinguish decision-making as a separate stage between perception and actualisation. The information interaction model emphasises that users operate within nested task and socio-organisational contexts that shape their actions. A user may perceive an affordance (recognise its possibility) but choose not to act on it due to competing priorities, institutional constraints, or misalignment with their goals. The original model conflates perception with actualisation, suggesting that perceived affordances are automatically acted upon. By separating decision-making, I create analytical space to examine the drivers (feasibility, viability, responsibility, desirability) identified by Ostern and Rosemann (2021)—factors that directly correspond to the task and socio-organisational contexts in the interaction model.

These adaptations transform affordance theory from a descriptive framework into a translational methodology that systematically converts information interaction insights into design specifications.

Affordances as a process concept

While the relational nature of affordances provides crucial theoretical grounding, understanding how affordances unfold in practice requires a process-oriented framework. Drawing on Pozzi et al.'s (2014) synthesis of affordance theory in information science, this project conceptualises affordances through a four-stage process model that has been successfully applied to information technology artefacts including data repositories (Wang et al., 2018; Wen et al., 2021). This framework enables systematic analysis of how Indigenous data sovereignty principles might be embedded within and actualised through repository systems.

Within this framework, affordances are modelled as having four stages: existence, perception, actualisation, and effect (Pozzi et al., 2014; Wang et al., 2018). This process model clarifies the distinction between what a repository makes possible and what users can actually do, moving beyond static feature inventories toward dynamic analysis of sociotechnical interactions.

The existence stage refers to what some consider the *objective* aspect of an affordance—the actions that the features of a technological artefact make possible, regardless of a user perceiving or actualising them (Wang et al., 2018). In repository contexts, existence encompasses the technical capabilities embedded within system architecture: metadata schemas, authentication protocols, access control mechanisms, and search functionalities. These features exist as potential regardless of whether users recognise or engage with them.

The perception stage occurs when users recognise possible affordances, influenced by object features, actor capabilities, goals, and external information (Wang et al., 2018). For Indigenous data sovereignty, perception depends on users' knowledge of Indigenous data sovereignty principles and repository capabilities. Affordance gaps occur when users do not perceive action opportunities due to inadequate signification (Sadler & Given, 2007).

The actualisation stage is when users take action to interact with the properties of an object to transform an affordance from a possibility to a reality (Pozzi et al., 2014). Actualisation depends not only on perception but also on users' capabilities, motivations, and the broader institutional contexts (Wang et al., 2018). Users typically take actions that support their goals, in our case, that either support or constrain sovereignty-respecting practices.

Finally, the effect stage captures outcomes from actualising affordances. Actors assess whether outcomes align with their goals, providing feedback that shapes subsequent interactions (Pozzi et al., 2014; Wang et al., 2018).

This process model provides methodological guidance for repository assessment that requires us to consider not only the availability of features, but user's context and whether they will perceive and take action to utilise available features. For example, a repository may include a field for community ownership (existence), but users must be both aware of the field and understand its purpose (perception), otherwise they may not complete it. Then, even if they recognise it, if they lack the tools, permissions, or institutional support to fill it appropriately (actualisation), then the intended outcomes—respect for community protocols—may never fully materialise (effect). This framing helps us identify not only whether sovereignty-supporting affordances exist within repository systems, but whether they are effective in achieving sovereignty-respecting outcomes. It also enables analysis of unintended effects that may emerge when affordances are actualised in ways that differ from designers' intentions.

The process model further recognises that user context significantly influences both perception and actualisation. Users' knowledge of Indigenous data sovereignty principles, their motivation to respect Indigenous data rights, which are influenced by personal ethics, disciplinary norms, and institutional requirements, and their technical capabilities all shape how affordances unfold in practice (Gregory et al., 2020; Rojas, 2024).

Affordance properties and signification

To operationalise affordances within Indigenous data sovereignty contexts, it is essential to understand their distinct properties, perceptibility patterns, and the signification mechanisms that enable their recognition and actualisation. Crucial to this process are signifiers (Norman, 2013)—the cues that communicate the presence and meaning of an affordance. Signifiers are culturally situated: what makes sense in a Western academic interface may not resonate with Indigenous community members. Without culturally appropriate signifiers, sovereignty-supporting affordances remain hidden or are misinterpreted, creating gaps between system design and actual

practice. Ostern and Rosemann (2021) provide a framework for analysing affordance properties that describes both the state and perceptibility of affordances. When integrated with Norman's (2013) concept of signifiers—the perceivable cues that communicate affordance possibilities—this framework enables systematic analysis of how sovereignty-respecting features are perceived, understood, and actualised across different user communities and institutional contexts.

Affordance properties

Affordances can be characterised as either canonical or relational based on their perceptibility patterns across user communities (Ostern & Rosemann, 2021). Canonical affordances are likely to be perceived and understood by everyone in the same way. They are determined largely by social conventions rather than individual user characteristics or designer intentions. Within repository contexts, canonical affordances include widely recognised interface elements such as search bars or download buttons, where the afforded actions are understood consistently across user groups due to established design conventions and shared signifiers (Norman, 2013). However, it is crucial to recognise that what constitutes a canonical affordance operates within particular organisational or sociocultural contexts; conventions that appear universal within Western academic environments may not be canonical for Indigenous community members who are operating from different technological and/or governance frameworks. The signifiers that make these affordances perceivable are culturally situated, requiring what Ramstead et al. (2016) describe as 'socioculturally scaffolded forms of affordance learning' to distinguish between natural affordances—relying on natural information—and conventional affordances—depending on cultural expectations, norms, and cooperative social practices.

Relational affordances, by contrast, are not determined by overarching social conventions but by the distinct relationship between a user and an object (Ostern & Rosemann, 2021). These affordances are more subject to particular users' contexts and are likely to be perceived and understood differently by different user groups. For Indigenous data sovereignty, many crucial affordances are inherently relational. The signifiers that make these affordances perceivable require cultural competency and contextual knowledge to interpret appropriately.

The framework distinguishes between hidden and false affordances, both critical for understanding implementation gaps in sovereignty-respecting repository design (Ostern & Rosemann, 2021). Hidden affordances exist regardless of perception. The affordance exists but is not made visible to users through adequate signifiers. There are possibilities for action, but these are not perceived by actors due to inadequate, missing, or culturally inappropriate signification systems. Within repository contexts, governance features might exist within the system architecture but remain hidden due to poor interface design, inadequate documentation, or lack of culturally appropriate signifiers. For example, a repository might technically support distinctions-based access control, but if researchers are unaware of this capability or cannot locate the relevant configuration options due to insufficient signification, the sovereignty-supporting affordance remains hidden and unusable.

False affordances represent the inverse problem; they are apparent affordances that do not have any real function (Ostern & Rosemann, 2021). The actor perceives possibilities for action that are non-existent, often due to misleading signifiers that suggest capabilities not actually implemented. False affordances can emerge when repository interfaces suggest capabilities through their signification systems that are not actually implemented, or when features exist but fail to function as expected within specific institutional or cultural contexts. For Indigenous data sovereignty, false affordances pose particular risks because they can create illusions of compliance while failing to provide actual governance capabilities.

The effectiveness of affordance actualisation in Indigenous data repositories depends critically on users' ability to interpret signifiers appropriately within cultural contexts. Standard research

ethics training does not prepare researchers for collective Indigenous data governance requirements, and researchers often lack an understanding of Indigenous worldviews and governance systems that inform data practices (Hudson et al., 2023). Without cultural competency, even well-intentioned users cannot perceive affordances that respect Indigenous data sovereignty. This challenge is compounded by persistent misconceptions and myths that obscure proper implementation of Indigenous data governance, such as the beliefs that involvement of a First Nations researcher automatically ensures data sovereignty compliance. These misconceptions show how inadequate cultural knowledge can lead to false perception of affordances. Users may believe they are acting in sovereignty-respecting ways when their actions actually perpetuate extractive practices. Cross-cultural training and raising the cultural competency of staff is essential for meaningful engagement with Indigenous data systems (Liggins et al., 2021). Without this competency, users cannot properly interpret signifiers or engage affordances in culturally appropriate ways. Studies confirm that ‘digital literacy acted as a mediator between perceived affordances and motivated learning behavior’ (Rojas, 2024), demonstrating that literacy—both technical and cultural—is not just helpful but essential for affordance actualisation.

Affordance drivers

Beyond perceptibility properties, Ostern and Rosemann (2021) identify key drivers—measurable resources that trigger affordance actualisation—and impact categories that describe anticipated or actual effects. The four primary drivers are feasibility (the degree to which actions can be easily or conveniently accomplished), viability (ability to work successfully within existing systems), responsibility (institutional and individual accountability for outcomes), and desirability (motivation to engage with available affordances). For Indigenous data sovereignty implementation, these drivers interact with signification systems in complex ways. A repository might include comprehensive Indigenous governance features with clear signifiers, but if institutional policies discourage their use (low viability), researchers lack appropriate training (insufficient responsibility), or academic incentives favour rapid sharing over consultation (low desirability), intended affordances won't be actualised.

Our framework should emulate the distinction between functional impacts—what an object provides for actors to accomplish specific goals—and social impacts—object-actor relationships aimed at supporting or constraining societal goals (Ostern & Rosemann, 2021). This distinction is particularly valuable for Indigenous data sovereignty because it enables analysis of how repository affordances operate simultaneously at individual task levels (functional) and at broader levels of community governance and cultural protocol maintenance (social). Signifiers play crucial roles at both levels, communicating not only what actions are possible but also their social and cultural significance.

In the next section I will apply the insights gained to the methodological guidance provided by this integrated property, signifier, and driver framework to position affordance properties and signification as complementary analytical tools for developing metrics-based assessment frameworks. This provides both diagnostic capabilities for identifying implementation gaps and design guidance for creating repository systems that effectively communicate and enable sovereignty-respecting practices across diverse user communities and institutional contexts.

Adapted affordance process model

In this section I will use the insights from the integrated property, signifier, and driver framework to adapt Pozzi et al.'s (2014) affordance process model in two important ways:

1. Adding signifiers as a mediating component attached to objects; and
2. Adding decision making as a distinct stage in the affordance process.

Each stage in this adapted process corresponds to specific components of the information interaction model. The existence stage maps to information objects and information technology infrastructure—the material substrate of repositories. The signifier component maps to interface functionalities—the mediating layer between system and user. The perception stage maps to cognitive space and polyrepresentation—how users recognise possibilities given their mental models and the multiple representations available. The decision-making stage maps to task context and socio-organisational context—the motivational and institutional forces that shape whether perception translates to action. The actualisation stage represents the moment of interaction itself—when user intention meets system capability. Finally, the effect stage feeds back into cognitive space, updating knowledge states and potentially reshaping future interactions. The resulting model improves repository assessment by enabling systematic diagnosis of affordance gaps and misalignments. The signifier component further directs as to consider the properties of the affordance and the decision-making component directs us to consider the drivers of the user's actions. Together, these modifications make the model more attuned to the sociocultural realities of Indigenous data governance.

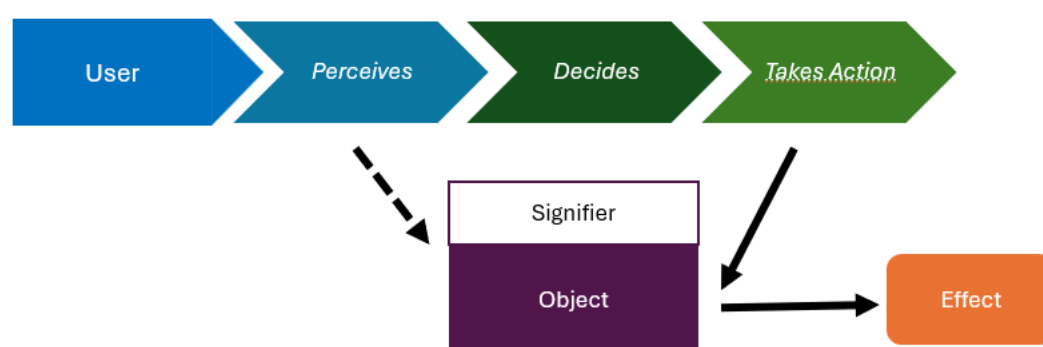


Figure 2. Adapted affordance process model. Adapted from Pozzi et al.'s (2014) affordance process model.

By explicitly adding the signifier component, I can move beyond simply inventorying technical features to analyse whether sovereignty-supporting capabilities are canonical or relational within target user communities, the effectiveness of an object's signifier and whether they remain hidden due to inadequate signification or are falsely perceived due to misleading signifiers. By adding decision-making as an intermediary stage in the process, I am pushed to consider what drivers influence decision-making and either enable or constrain their actualisation. It is the evaluative process through which users weigh whether, how, and to what extent they will engage with a perceived affordance, given their goals, responsibilities, and constraints.

Separating decision-making from perception and actualisation is particularly important in the context of Indigenous data sovereignty. A user may perceive a sovereignty-supporting affordance, such as a metadata field for recording community ownership or a consent-management module, but still decide not to act on it. That decision may be shaped by limited time, uncertainty about community protocols, lack of institutional incentives, or even a deliberate choice to bypass Indigenous governance requirements. Conversely, a user may decide to act but then be prevented from actualising the decision by technical barriers (e.g., restricted permissions) or institutional disincentives. Decision-making thus captures the ethical, contextual, and relational dimensions of user practice that are often invisible in purely technical or cognitive models.

By adding these additional components, I can better inform targeted interventions: educational initiatives to increase cultural competency for interpreting Indigenous governance signifiers,

interface redesign to address hidden affordances through improved signification systems, policy changes to improve viability and responsibility drivers, or signifier redesign to eliminate false affordances that create compliance illusions. This expanded model clarifies why sovereignty-supporting features in repositories often fail: it is not enough for an affordance to exist or even be perceived; users must also be motivated and enabled to act on it in ways that align with Indigenous governance. Extending the affordance process model to include decision-making acknowledges that perception alone does not ensure action. Cultural norms, institutional incentives, and individual motivations shape whether a perceived affordance is acted upon. Similarly, adding signifiers emphasises that affordances are not self-evident: they must be communicated in ways that resonate with users' cultural frameworks—which can be modelled using the data culture framework in the next section.

Mapping information interaction to affordance theory: A systematic integration

This systematic mapping reveals how affordance theory operationalises the information interaction model. Where Ingwersen and Järvelin explain why users perceive and act differently (cognitive states, contexts, intentions), affordance theory provides the mechanism for translating these insights into design specifications. The cognitive space becomes the lens through which affordances are perceived; interface functionalities become the sites where signifiers communicate possibilities; and task contexts supply the motivational frame that drives actualisation decisions.

Information Interaction Component	Affordance Theory Concept	Translation Mechanism
Cognitive space (knowledge, intentions, mental models)	Perception stage + decision-making	Mental models condition which affordances are perceived; intentions drive which affordances are actualised
Interface functionalities	Signifiers + existence stage	Interface elements serve as carriers of signification that make potential affordances perceivable
Task context (work tasks, information needs)	Actualisation drivers (desirability, responsibility)	Task-driven goals determine which perceived affordances users choose to actualise
Socio-organisational context	Affordance drivers (viability, feasibility)	Institutional norms and policies constrain or enable affordance actualisation
Information objects (representations)	Object properties (features)	System features create potential affordances (existence stage)
Polyrepresentation	Multiple canonical/relational affordances	Diverse representations increase likelihood that affordances resonate with varied cognitive states

Table 2. The translational mechanisms between information interaction components and affordance theory concepts.

Mapping governance: Applying affordance theory to repository design for Indigenous data territorialisation

The Tsimshian Archaeological Spatial Archive (Gupta et al., 2023), created through collaboration between the University of British Columbia and the Nine Tribes of Lax Kw'alaams and Metlakatla, exemplifies how the integration of the information interaction model and the affordance process model can translate Indigenous data sovereignty principles into concrete design. The archive's

principal geospatial search interface reconfigures archaeological data navigation around the spatial and relational logics through which Tsimshian knowledge is traditionally organised. Rather than relying on hierarchical metadata or taxonomies, the Tsimshian Archaeological Spatial Archive enables users to locate digital objects—documents, photographs, videos, and artefact records—by exploring an interactive map connected to ancestral territorial geographies,

The spatial archive enables Indigenous community members in using knowledge of their territory to find data that university archaeologists have compiled for specific places, without familiarity with archaeological taxonomy or the province's site-naming conventions. (p. 83)

This interface situates information-seeking within a cognitive and cultural frame that aligns with Tsimshian relational spatiality, transforming the act of search into an engagement with place.

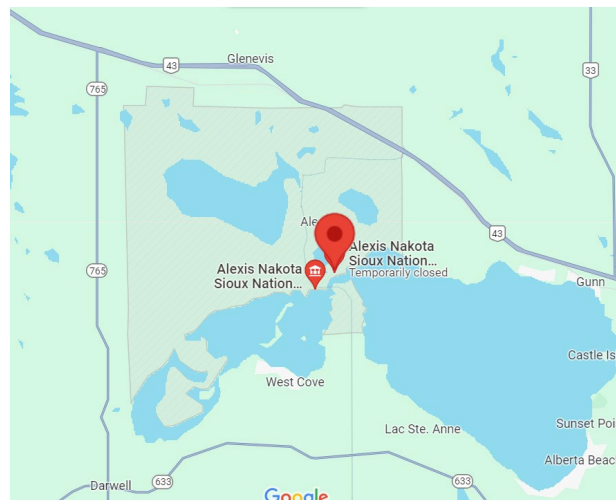


Figure 3. Example of Google Maps based search interface.

Through the lens of Ingwersen and Järvelin's information interaction model, the Tsimshian Archaeological Spatial Archive demonstrates how interface functionalities mediate between information objects, user cognitive space, and socio-organisational context. The Google Maps framework functions as both information technology infrastructure and cognitive intermediary: it externalises geographic knowledge and invites users to interpret data through situated perceptions of territory. This interactional mapping establishes the conditions under which affordances become perceivable—what Pozzi et al. (2014) describe as the perception stage in the affordance process model. The familiar spatial representation acts as a visual signifier that cues meaningful action: to click, explore, or retrieve information linked to a location. The interface thus bridges cognitive and technical representations, turning latent existence affordances (geotagged data) into perceived and actualisable ones by resonating with community epistemologies.

The decision-making and actualisation stages show how cognitive intentions and sociocultural drivers converge. As community members interact with the spatial archive, decision points—such as viewing permissions or data-sharing protocols—are framed not as bureaucratic compliance steps but as natural extensions of territorial governance. The repository's sovereignty-based access structures operationalise what the information interaction model identifies as contextual drivers: collective norms, institutional arrangements, and intended goals. These sociocultural contexts are transformed into measurable drivers of action—responsibility and desirability—that motivate users to actualise governance-respecting affordances. The interface not only supports sovereign access but makes sovereignty perceivable as an inherent property of interaction.

Finally, in the effect stage, the cyclical interplay between user cognition and system environment becomes visible. As community members explore place-based heritage data, their cognitive structures evolve; knowledge is both retrieved and extended, reinforcing local epistemologies of place and stewardship. The system, in turn, learns from these interactions, progressively enacting what Ingwersen and Järvelin frame as iterative cognitive feedback loops wherein information behaviour reshapes both meaning and system affordances. In this mutual feedback between interaction and affordance, the Tsimshian Archaeological Spatial Archive demonstrates the translation of relational theory into praxis: a repository that is simultaneously a semantic map, a governance infrastructure, and a cognitive interface.

The Tsimshian Archaeological Spatial Archive's geospatial search thus synthesises the two theoretical models: the information interaction model clarifies how users perceive and construct meaning through contextual cognition, while the affordance process model explains how these perceptions are operationalised through sequential stages from existence to effect. Together, they reveal that spatial organisation is not merely a design choice but a sovereign affordance—a way of structuring digital knowledge in alignment with Indigenous relationships to land, knowledge, and governance.

Conclusion

This paper has demonstrated how affordance theory serves as a methodological bridge between information interaction models and repository design practice. By integrating Ingwersen and Järvelin's cognitive-contextual framework with Pozzi et al.'s affordance process model, I have established a translational mechanism that systematically converts abstract understandings of user cognition, context, and intentionality into concrete design specifications.

The key to this integration lies in recognising complementary analytical strengths: the information interaction model excels at explaining why users act as they do (what cognitive structures, task demands, and contextual pressures shape their behaviour), while affordance theory excels at prescribing what systems must provide (what features must exist, how they must signify, what decisions they must support). Together, they form a complete design methodology—from user research to system specification, from interaction analysis to feature implementation, from cognitive diagnosis to interface intervention. Three key contributions emerge from this integration. First, the adapted affordance process model—which explicitly incorporates signifiers and decision-making as distinct stages—provides analytical precision for diagnosing implementation gaps between intended and actualized governance outcomes. Second, the framework's attention to affordance properties (canonical vs. relational, hidden vs. false) enables systematic evaluation of how effectively repository features communicate their capabilities across diverse user communities. Third, extending the information interaction model to account for users' dual roles as both information seekers and data managers reveals design requirements that traditional models overlook.

While I have illustrated these concepts through Indigenous data sovereignty contexts—where complex governance requirements and cross-cultural signification challenges make affordance gaps particularly visible—the framework applies broadly. Any repository system requiring context-sensitive governance, culturally appropriate signification, or user-driven stewardship can benefit from this affordance-based approach. The translational power of affordance theory lies precisely in its ability to make relational, contextual phenomena analysable and designable, bridging the persistent gap between information practices research and systems design.

About the author

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