Interpretive Collaborative Review: Enabling Multi-Perspectival Dialogues to Generate Collaborative Assignments of Relevance to Information Artefacts in a Dedicated Problem Domain

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Abstract

Interpretive Collaborative Review (ICR) is a process designed to assemble electronically accessible research papers and other forms of information into collaboratively interpreted guides to information artefacts relevant to particular problems. The purpose of ICR is to enable collective understanding of a selected problem area that can be developed and represented by evaluating (reviewing) selected artefacts through a collaborative deliberation process. ICR has been conceptually formalized as an online environment enabling collaborative evaluation of relevancy relationships articulated in the triad of: 1) specific problems (topic), 2) diverse stakeholders and reviewer perspectives (context), and 3) particular settings where the problem matters (task). We define relevance as a cognitive recognition of proximal meaning relationships among the triad nodes of topic, task, and context. Three necessary dimensions of relevance relationships are proposed: 1) precedence, 2) validity, and 3) maturity. Based on experience with other forms of collaborative knowledge construction such as structured dialogue and cooperative learning, we conceptualized the ICR process as encompassing three phases: 1) discovery, promoting initial interpretations and definition, 2) deliberation, promoting emerging understanding and acceptance of degrees of interpretation within the group and 3) dissemination, promoting summation, validation, and distribution or publication of conclusions. The ICR method starts by recruiting a community of reviewers with necessarily diverse perspectives who agree to collaborate in identifying and evaluating information artefacts that can inform knowledge construction centered on a problem of common interest. A discovery phase allows reviewers to declare perspectives that are further delimited and explored collaboratively through the use of group dialogue around challenge questions. This is followed by a deliberative phase that facilitates collaborative dialogue aimed at developing a shared understanding of available information artefacts and their significance and of how those sources are relevant to the problem context. A final dissemination phase involves recording and publishing the knowledge synthesis and innovation that emerged from this collaborative dialogical process to affect knowledge transfer. Alignment of perspectives is promoted through collaborative generation of an aggregated report that describes the perceived relevancy relationships for each knowledge artefact evaluated in the review collection. While useful by itself, this report also serves as the raw material for a new form of scholarly publication, the 3D-Review, where relevancy relationships are used to guide suggested actions that could be taken with respect to advancing knowledge of the problem and options for addressing it. Both reports and reviews are indexable and electronically accessible, allowing other communities or individuals to find, retrieve, and act upon the new knowledge associated with the reports and reviews. This process of rigorous and purposeful deliberation enabled through online support of honest dialogue has the potential to develop into a new form of scholarly activity that should be useful in integrative scholarship.

Keywords: collaborative review; multiperspectival dialogue; information relevancy; online deliberation; integrative research; knowledge synthesis.

1.   Introduction

1.1   What is ICR.

We are developing an interpretive collaborative review (ICR) process that will enable *ad hoc* review of published literatures and their data.   The aim of the ICR process is to facilitate and record human perceived relevance of these information artefacts within the context of construction of knowledge concerning a specific applied research question, especially concerning interdisciplinary and wicked problems1. ICR facilitates multi-perspectival dialogues to generate collaborative assignments of relevance to information artefacts in a dedicated problem domain. Unlike peer review, which reinforces dominant disciplinary perspectives by privileging within-discipline peer assessment, ICR affirms the necessity of including and validating the multiple perspectives necessary to understand a complex problem and to inform decision making. The ICR process is designed to lead to online distribution of an ICR publication that summarizes and reflects upon conclusions of the discovery and deliberation characteristics of ICR process. We anticipate that these 3D-Reviews (Discovery, Deliberation, and Dissemination) will serve a need for rapidly-generated, problem-focused scholarly interpretations of the literature, available evidence, and data relevant for addressing significant practice and research questions. The 3DRs are envisioned as a venue for disseminating integrative research [2], or the deliberate association of multiple perspectives in interdisciplinary research problems, increasingly important in healthcare, disease management, planning, and other domains characterized by wicked problems.   Here we describe a theoretical and conceptual framework for designing this ICR process.

1.2   Why ICR is Needed

The increasing rate of publication sponsored by massive investments in discovery and technology development has generated a bewildering array of knowledge and information artefacts most of which are now accessible in a digital form. Digital information artefacts include: research reports, medical records, original research data, audio/video recordings, maps, images, financial documents, legal forms and case-law texts, databases, websites, public records, etc. An equally massive "knowledge aftermarket" corpora of internet accessible white papers, reviews, books, proceedings, and guidelines have been published and archived. They represent attempts to interpret and make meaning from the original published body of research as well as other forms of information artefacts and to make them more accessible. This deluge of data, articles, and communications [4,5], both published and unpublished, creates significant complexity and cognitive load for scholars. Especially when engaged in multidisciplinary and integrative research, scholars may experience uncertainty with respect to the validity or perspectives of published accounts outside of their primary field. Significant cognitive overload burdens are to be expected in assessing and interpreting research findings, their contexts of meaning and definition, methodological soundness, and disciplinary applicability. Practitioners, developers and consumers who want to use the information for practical purposes face even more headaches than scholars. Appraisal of the published literature that might be relevant to a practice becomes a daunting exercise in sensemaking for professional information seekers [6] and even more so for the public at large [7], as they are increasingly viewed as a consumer of health and biomedical information [8]. In addition, new views are emerging about opportunities for how digital data and accessible digital information artefacts can be reused that will likely transform the nature of scientific publishing in the future [9].

Yet, in applied and practice-oriented health professional disciplines, such as medicine, nursing and pharmacy, we find a continuous need to interpret, translate, and make clinical decisions based on rapid but non-trivial assessments of the current agreement of positions drawn from scientific research [10]. While there are review journals and even informatics services designed to supply summaries and expert assessments, these review services suffer from often severe publishing latency and inconsistent quality [11,12]. Moreover, evidence evaluation services (Cochrane, MDLinx) deliberately ignore much of the literature and favor specific perspectives (e.g., evidence-based medicine) over others [13]. There is a need to provide a guide to assist practitioners and multidisciplinary researchers in directly evaluating the literature as well as published and electronically accessible data. There is also a need to highlight the theoretical knowledge frameworks that guide construction, presentation and interpretation of research data and findings [14].

Both the interpretive and original scholarly literatures of all disciplines and the data and material they are based upon can now be accessed via digital libraries, repositories, publisher services, and OPACs hosted by academic libraries [5]. This accessibility has been developed by investments by universities and governments' through the promotion of public research libraries and open access regulations [15] as well as through innovative services developed and marketed by publishers. Since almost any published product of research and interpretation can now be delivered through the Internet, few technical barriers remain to achieve reliable archiving and retrieval of all forms of information artefacts. These include primary research papers but also include other forms of text based sources (e.g. patents, white papers, reviews, indexes, transcripts, etc) and increasingly other forms of rich media sources.   But despite (or due to) advances in subject information retrieval, information seekers often face intractable information-seeking problems related to information opportunity overload, knowledge overproduction, and disciplinary language complexity. Some scholars propose the need for gatekeepers has increased, not diminished, due to overload and the information seeker's inability to acquire sufficient context [16]. ICR is a generative, anticipatory approach to gatekeeping, wherein interested scholars and stakeholders – but not necessarily *experts* in a problem – review and formally assess knowledge artefacts, the ideas within them, and their relationships to the problem to enable their dissemination as indexed scholarly review products available to open web searching.

Publications have become so specialized that adaptation of knowledge between disciplines becomes an ever-increasing challenge, a cultural language challenge not resolved by technology. Even within major disciplines, competing factions arise and persist over decades, resulting in fragmented perspectives and guidance for major applications, such as healthcare and drug therapies. With over 600,000 new articles from almost 5,000 journals indexed by the National Library of Medicine in 2006 in the domain of healthcare alone [17], practitioners and researchers have trouble identifying and locating information that is germane (useful), interpretable (usable), and directly applicable (ready to use) to specific problems faced in their practices and their studies. This problem becomes particularly acute when practitioners and researchers are engaged in interdisciplinary integrative research aimed at delivering knowing in action. [18]

 While there are language translators available on the web, we know of no *disciplinary* or problem space decoders that effectively translate the relevance of given publications for the trans-disciplinarians interested in wicked problems. Such a decoder would need to be trusted. Indeed, Thiede [19] has argued that trust plays a key role within the transactional process of information exchange and communicative interaction. Moreover, he points out that trust both enables and is generated by communicative interaction. For too long information access strategies have relied on authority rather than trust to help guide distribution of information. Information access must go beyond the mere possibility of access to embrace development and engagement of a capacity for access by communities and individuals. The decoder would also need to be dynamic, improving its functionality through the sharing of experience by its users. The ICR process is being designed to serve this decoding function.

2.   Background.

2.1   The Nature of Relevance

The ICR process is being designed to create a new venue for applying scholarship in the 21st century through relevancy mapping. Since we are advocating the need for collaborative, humanly-assigned relevancy, we propose a model for associating a scale of relevancy indicators to artefacts. The purpose of this discussion is to share the theoretical background, and we do not show the scoring method alternatives in this paper.

The adjective *relevant* is derived from the Latin word *relevare* meaning to raise up or highlight. In most forms of common usage relevance refers to properties and attributes of an information source that has bearing upon, is connected with, or is pertinent to a matter at hand[20]. Table 1 summarizes what we perceive as analogous nodes of meaning within conceptualizations of relevance and knowledge. Saracevic´s [21], Phenomenology framework for characterizing relevance emphasizes the importance in relating knowledge seeking themes developed by individuals and the social situation, or Shutz's ¨lifeworld,¨ [22] in which this theme operates. This formulation explicitly recognizes the social and constructed nature of relevance. Shutz recognizes relevance as being composed of a system of relevancy relationships consiting of *topical* relevance, *interpretational* relevance, and *motivational* relevance. These relationships reflect the knowledge relationship as understood within a practice or scholarly community. Wenger's [22] framework describes three dimensions of knowledge within a community of practice: *what is it about*, *how it functions*, and *what capability it has produced*.[23]. This corresponds to the three knowledge domains specified by Spender [24] of 1) data (abstraction), 2) meaning (codification) and 3) practice (diffusion).

Mizzaro [25] has defined relevance in an information retrieval (IR) context as a relation useful in guiding IR that exists between any two entities of two groups. Where one group includes: documents, their surrogates, and the information they contain. The other group includes: problems, information needs, information requests, and information queries. Each of these relevancy relationships can be further decomposed into influences related to the topic, the context and the task. Thus, Mizzaro [25] like many others defines relevance as a system of articulating relevancy relationships. This system of relevancies is applied in different types of sensemaking or abouts. Maron [26] has distinguished between three *abouts*: 1) the subjective about (the relation between the information and the resulting inner experience of the recipient), 2) the objective about (a well defined explicit and external point of view) and the 3) retrieval about (the consequences of making that information available). These distinctions roughly reflect the different approaches for organizing knowledge: ontological, epistemological and methodological [14]. Building on these insights we define relevance of an information artefacts to a problem as: *a quality or attribute either providing guidance (it is germane and pertinent), perspective (it is material and valid) or options (it is applicable and mature) to a practice, situation, issue, problem, subject or other matter at hand*. We will refer to these three quality dimensions as: pertinence, validity and maturity (Table 1).

2.2   ICR as a form of Collaborative Informatics

Collaborative informatics is an emerging information practice developing from the requirement to improve decision making and understanding among professionals in research and practice by drawing from and integrating multiple personal and disciplinary knowledges and perspectives. Shortliffe and Blois [27] define (biomedical) informatics as: the scientific field that deals with (biomedical) information, data, and knowledge - their storage, retrieval and optimal use for problem solving and (their optimal use for) decision making.

We view collaboration as a structured recursive process where multiple individuals work together toward a common goal - typically an intellectual endeavour that is creative in nature - by sharing knowledge, learning and building consensus [28]. An important feature of collaboration is that it does not require leadership only communication and self-organization. Scholarly or professional collaboration occurs within a community of practice comprised of members with distinct responsibilities and competencieswho are mutually dependent on each other to accomplish the shared practice goals. Collaborative inquiry or learning within a group of stakeholders should be multilateral where all members are expected to participate and benefit from the process. Pennefather and Suhanic [29] have described how diagnostics (the structured decision support leading to a diagnosis) resembles the stages of learning described by Bloom´s taxonomy [30] and the stages of a structured inquiry that guides structured dialogic design [31]. These levels can be aggregates into three distinct phases (Table 2): 1) Discovery, 2) Deliberation, and 3) Dissemination.In a sense the ICR is a form of collaborative diagnostics aimed at developing a shared understanding of the meaning of the relevance of a collection of information to a particular problem.

SOURCE	Precedence (Germane) fit to the issue (guidance/topic)	Validity (Material) ways of knowing the issue (perspectives/insight/context)	Maturity (Applicable) usability & actionability (options/applicability/task)
Shutz (22)	Topical	Interpretational	Motivational
Wenger (23)	What is it about?	How it functions?	How can it be used?
Spender (24)	Meaning	Data	Practice
Maron (26);	Subjective About	Objective About	Retrieval About
Thomas (14)	Ontological	Epistemological	Methodological
Amin & Roberts(18)	Professional	Epistemic/Creative	Craft/Task based

Table 1 Dimensions of relevance and their analogy with other conceptualizations of knowledge

	Learning[1]	Interactive Inquiry[2]	Diagnostics[3]
Discovery	Comprehension	Discovery/Engagement	Initiation
	Application	Definition/Mapping	Sensing
Deliberation	Analysis	Design	Analysis
	Synthesis	Decision Making	Diagnosis
Dissemination	Evaluation	Action Planning	Reporting

1 Bloom [30];   2 Schreibman and Christakis [31] ; 3 Pennefather and Suhanic [29]

Table 2. Analogous levels of different forms of collaborative construction of knowledge

3.   Theory and process of ICR

3.1   Toward a theory of problem-centered knowledge communities

We have adopted a constructivist perspective in designing the ICR process. Participants in an ICR process are viewed as members of a learning community, even a community of practice formed around a problem of common interest [18, 23]. This community is defined by the triad of: 1) specific problems (topic), 2) diverse stakeholders and reviewer perspectives (context), and 3) particular settings where the problem matters (task) [25]. Relevance will exist and be recognizable to the community as an articulated network of relationships linking aspects of meaning expressed through this triad. The goal of the ICR is to make evident the individual meanings perceived by community members and to explore the consensus that develops regarding that meaning through ICR mediated deliberation. The ICR process aims to create an environment where necessarily multi-perspectival communities can collaboratively build knowledge and construct meaning. We anticipate that this collaboration will generate new synthesis, innovation and transfer of knowledge which can be fed back into a larger system of published reviews, citations, and

accounts.

A key role for any form of review is to identify within a plethora of alternatives a subset of specific information sources that are relevant to specific needs and to explain why those sources are significant. This is a form of knowledge synthesis which infers generalities form specific instances. The Canadian Institutes of Health Research has defined knowledge synthesis as ¨the contextualization and integration of research findings of individual research studies within the larger body of knowledge on the topic¨. This is seen to be an essential first stage in knowledge transfer and translation. Knowledge translation is defined by CIHR as ¨a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically sound application of knowledge to improve the health¨ [32].

In our opinion, the best reviews integrate synthesis, innovation and transfer of knowledge. In a sense such reviews help information seekers to develop scholarly literacy as it relates to problems those seekers are concerned with. This is especially true when the problems impinge on fields of knowledge within which seekers have limited experience. The UNESCO definition of literacy states that it is "*the ability to identify, understand, interpret, create, communicate, compute and use printed and written materials associated with varying contexts. Literacy involves a continuum of learning to enable an individual to achieve his or her goals, to develop his or her knowledge and potential, and to participate fully in the wider society*"[33].

An important outcome of literacy is an increased and continual access to knowledge and with continued learning in a problem area comes the generation of new knowledge. Knowledge can be thought of as "justified true belief" that increases the capacity for effective action by a community of practice or a community sharing a common problem or goal [34]. Thus, literacy can be conceived as a capacity to access and exchange knowledge and serves an important role to helping a group engaged in sharing knowledge to judge the relevance of information to a particular problem. Another aspect of literacy embodied in the literate scholar is the quality of perceptiveness, which we see as the enabling of tacit knowledge to recognize patterns that may be overlooked by others but become apparent once pointed out.

Tacit knowing [35] is essentially "that which we know but cannot tell," and is considered both the basis and consequence of expertise and deep domain knowledge acquired over time by practice and reflection. We propose that Nonaka's [34] dynamic model of knowledge creation (based on a cycle of knowledge exchange among members of a community, Fig 1) matches the desired ICR process where the community would be a virtually-organized problem-review team. The ICR process is being designed to supports most and perhaps all of the four-phase cycle of knowledge creation, effectively in an online collaborative dialogue setting. This cycle supports a model of knowledge synthesis, translation, innovation, and transfer through exchanges among reviewers reflecting different disciplinary perspectives and also necessarily different tacit sources of expertise and experience. It is this form of knowledge Nonaka [34] translation that we seek to embody in the ICR process.

Nonaka [34] presents a conceptual cycle of knowledge translation from tacit to external forms, then returning external back to tacit, embedded knowledge when it has been learned and internalized effectively. In this cycle, tacit knowledge, inherent in expertise and deep disciplinary knowledge, is translated or exchanged in collaborative dialogue in the ICR process. As reviewers select, review, and assign relevance scores to artefacts in a problem-centered collection, they reveal perspectives, knowledge preferences, and are compelled to state claims that might otherwise remain as tacit knowing regarding a problem. The socialization process noted in the upper left part of this cycle is inherent in scientific communities, a tacit to tacit exchange wherein background knowledge and explicit support for claims is left unsaid, and remains understood as part of the community's background of knowledge. The ICR process aims to make this exchange evident and accessible, revealing the development of background assumptions, foundational concepts, and inherent expertise.
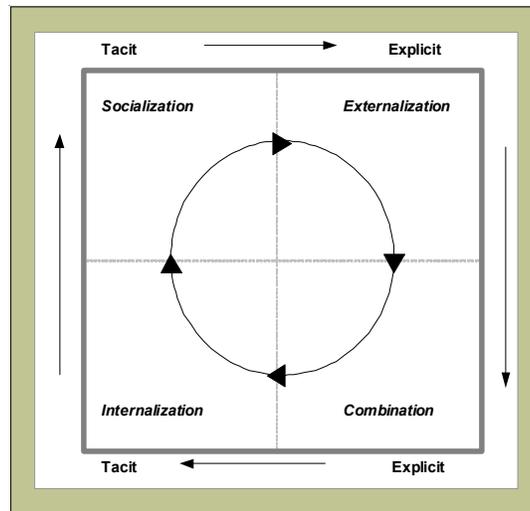
Figure 1. Tacit knowledge translation cycle [34]

Scholars recognize their identification with an "invisible college" community to the extent they have internalized the encoding and shared background of a problem area or discipline. But since we are interested in amplifying weaker signals of meaning in order to articulate or bind together interdisciplinary research and to strengthen the collaborative review. Our intent with ICR is to recruit and disclose the tacit formulations researchers may hold. We do so by engaging their perspectives through having them collaboratively reviewed and published as accessible knowledge artefacts that inform a problem or decision domain. The translation from tacit to "explicit," what Nonaka calls *externalization*, is necessary to produce an exchange of form in the sharing explicitly interpreted claims in an ICR review. Especially in a review context, knowledge claims that may seem obvious to an expert will be revealed and explicated (externalized) in a form available to non-peer participants, requiring a translation process that combines perspective and knowledge claim within a capsule review form. We view this explicit exchange of reviews, while peripheral to any directed aim of "problem solving," as supporting participants in formulating the "combination" of knowledge identified in the knowledge creation/translation cycle. The disseminated ICR publication further combines knowledge represented in the individual reviews, the references to selected artefacts, and the continuation of dialogue among new participants in the intentional community surrounding the problem of interest.

3.2 Informatics Model of the ICR process

The ICR process has been conceptually formalized as an online environment that convenes a multi-perspectival, temporary, problem-centered community to facilitate collaborative evaluation of generalizations. While other prototypes and services have been identified that have attempted a similar process (e.g. Digital Document Discourse Environment [36]), these other approaches differed in significant ways from the current design. Some of these distinctions include: 1) it is explicitly problem or question centered, 2) it engages multiple perspectives by design, 3) a strong editorial role is taken to ensure quality control and artefact selection, 4) a strong model of human-assigned relevancy is embedded in the process, and 5) this relevancy model is construed as an open indexing schema. Other differences exist in the theoretical frames underpinning the ICR, such as: 1) its strong view of knowledge translation and collaborative dialogue, 2) an inherent theory of scholarly motivation, and 3) a requirement or goal to distribute an indexable publication as a collaborative outcome.

We articulate the ICR process as the triad of 1) specific problems, 2) diverse stakeholders and reviewer perspectives, and 3) particular settings or venues. These are linked to information about perceived relevancy

to generate shared meaning for a defined problem. We assert that a dialogical collaborative evaluation process is necessary to conserve tacit knowledge of autonomous participants within this community and to test knowledge propositions efficiently. Effectiveness of this dialogical process requires recognition of participant autonomy and authenticity, parsimony of resources, and an allowance for evolutionary learning and opinion changing in the process [31].

While not yet fully developed as an interactive prototype, the process has been tested in classroom and design settings. Fig 2 outlines a proposed ICR workflow that prototypes will have to support. The general workflow aims to develop an inclusive and non-hierarchical online process that allows assembly of a limited group of interested parties with diverse perspectives to arrive at agreement about the substance and extent of a problem and its deliberation. Participants engage in a collaborative effort to discover, deliberate about, and evaluate the relevancy of artefacts selected and screened by participants as candidates for the review. This live intervention enables access to tacit internal and external knowledge networks available to reviewers.

The ICR process shares some surface similarity to the canonical scholarly publishing process, involving editors and boards of selected reviewers. The most significant difference is the *ad hoc* nature of the ICR, where a review may be registered (online) and organized at the time a problem area is identified for review. The ICR is initiated by an editor who may individually or by convening an editorial board establishes a new ICR focused on a problem of concern to some community. The ICR is formulated around a triggering question, which may be identified by the editor (1), or circulated in review with up to 2 candidate questions.
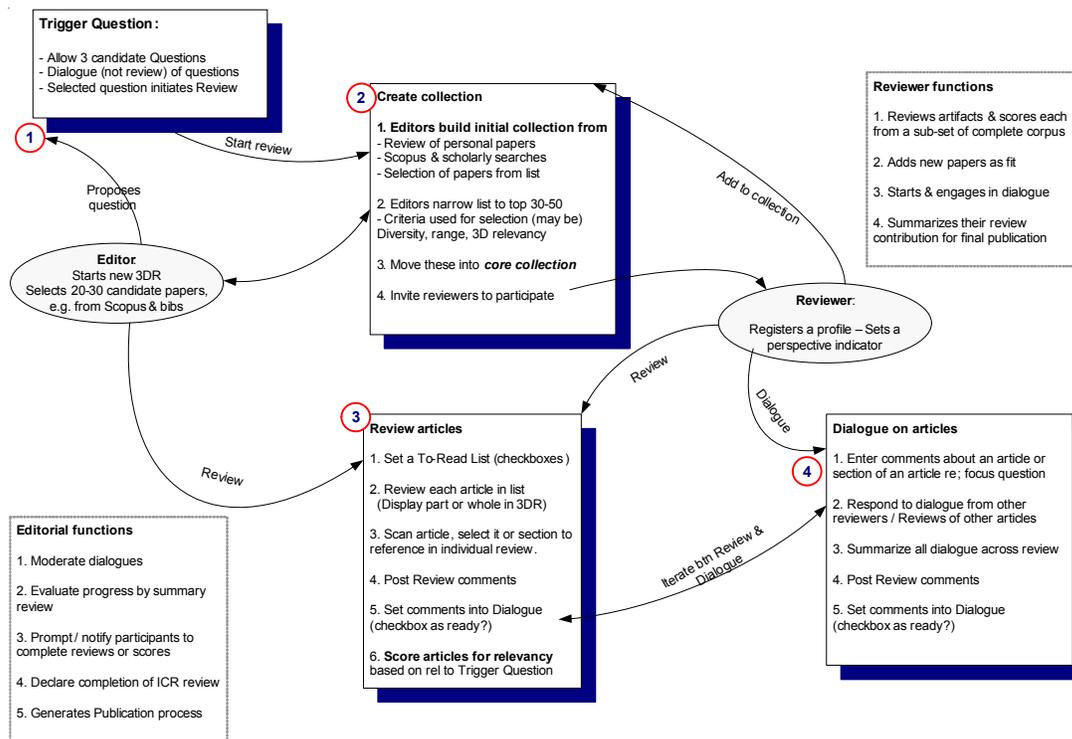

Figure 2. ICR process flow.

Figure 2 illustrates four processes, each showing a clear listing of steps or tasks engaged in the process. The specification and framing of the trigger question (1) is one of the most important decisions of the editor, as the question sets the scope for relevancy of materials. The trigger question must invite and allow

multiple perspectives to converge on the problem itself, and should not introduce jargon or coding that disenfranchises perspectives. The "problem" as perceived by participants will invariably be judged by the needs of their personal disciplines and experiences, and the ICR is designed to specify a problem scope in the form of a question (or set of nested questions) that inspires multilateral inquiry.

Given the formulation and review (and voting) on the trigger question(s) as the scope, the reviewing editors (2) each contribute sets of artefacts (papers, materials, data) they consider initially relevant to the problem and question. The editors conduct a scoping review of sorts to narrow the set of artefacts to be reviewed (by the full panel of review participants) to a manageable number of initiating items. This set of materials becomes the initial core collection to be reviewed, scored, and deliberated by participant reviewers. Participants are invited to join the ICR for a problem domain question for which they are known or are expected to share interest. They are invited to register and to declare a perspective relating to the question in their background statement. Reviewers select articles (3) from the core collection that they choose to read, identify key ideas that may be linked as information objects in the review, and they write a brief review of their contribution. Reviewers then score the article for its relevancy to the *problem*, based on their review and consideration of its validity, maturity, and precedence as a contribution of published knowledge to a problem. In the next iteration participants can suggest new material to be reviewed, commented upon and scored. This process proceeds until a shared understanding is deemed to be sufficiently evident.

Reviewed articles are disclosed to participants as available for dialogue, which differs from other types of scholarly commentary. In an ICR, deliberation (4) questions and develops ideas drawn forth in the reviews themselves, not the articles *per se*. The ICR process is being designed to elicit significant passages from articles in the collection, amplified by review commentary, and proffered to the community of reviewers for deliberation. The intention of this method is that of drawing out salient and even citable concepts that may have been overlooked in prior reading of the articles or of similar literature or perspectives.

When editors declare the review completed, the full ICR corpus may be baselined and published online as a collection. Very soon, most of the desired primary publications that might be incorporated in a collection (as defined in the Creative Commons licensing language) will be available from freely accessible preprints of published papers [15]. This collection would include the artefact reference lists, the artefacts selected for review (and those dismissed with respect to the question), the reviews and deliberative comments on the core collection, and the relevancy scores. This rich set of contextual materials will be published as an ongoing inquiry, with the invitation for other interested readers, scholars and practitioners, to further engage with the online review publication. This report can also be mined and integrated into an even more interpretive review where knowledge is integrated and specific conclusions related to the problem area are advanced.

3.3   The ICR as a Novel Scholarly Publication

We conceive the outcome of an ICR process as a completed review publication, similar to an online review journal in genre. We conceive of this publication as a complete set of reviews and dialogues associated directly with articles (artifacts) within an interactive website indexed by these texts, and findable by association to the trigger question. By searching text associated with the issue, and by browsing subject taxonomies that link a problem to multiple subject classifications and keyword tags, we believe the ICR will serve as a timely response to scholars interested in similar questions to those explored in the ICR review. Figure 3 illustrates the format of the publication and its post-publication indexes. The published ICR report and 3DR disrupts current publication categories. Figure 3 shows the "masthead" declaring the publication as similar to a review journal or special issue, with an issue editor, and perhaps a series or imprint editor if a "sponsored" ICR. Being a novel published format, the preferred bibliographic information and citation are identified, and the permanent and alternate web locations noted as well. The online format

is conceived as an expandable collection of the ICR components, with contextual statements added by the editors to produce an interactive, readable, responsive online publication. Depending on the intended audience the reports and reviews can be associated with a digital library of artefact's or simply bibliographical pointers to the accessible locations of these artefacts.
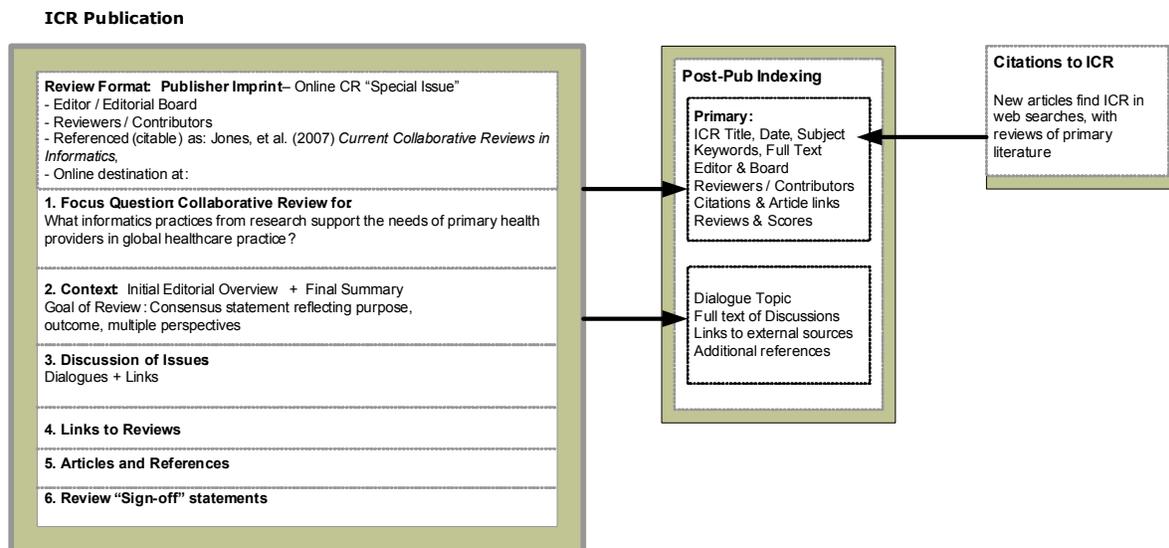
ICR Publication

| Review Format: Publisher Imprint– Online CR "Special Issue" |
| - Editor / Editorial Board |
| - Reviewers / Contributors |
| - Referenced (citable) as: Jones, et al. (2007) *Current Collaborative Reviews in Informatics*, |
| - Online destination at: |
| **1. Focus Question Collaborative Review for** |
| What informatics practices from research support the needs of primary health providers in global healthcare practice? |
| **2. Context**: Initial Editorial Overview + Final Summary |
| Goal of Review: Consensus statement reflecting purpose, outcome, multiple perspectives |
| **3. Discussion of Issues** |
| Dialogues + Links |
| **4. Links to Reviews** |
| **5. Articles and References** |
| **6. Review "Sign-off" statements** |

Post-Pub Indexing

Primary:
ICR Title, Date, Subject
Keywords, Full Text
Editor & Board
Reviewers / Contributors
Citations & Article links
Reviews & Scores

Dialogue Topic
Full text of Discussions
Links to external sources
Additional references

Citations to ICR

New articles find ICR in web searches, with reviews of primary literature

Figure 3. The ICR publication and post-publication indexing.

Post-publication indexing shows that certain document descriptors will be established as metadata and indexing terms for pervasive web indexing and findability in search engines and scholarly index services. A novel function of the ICR publication will be the text indexing of newly contributed materials in reviews and dialogue. All of these contributions could, in theory, be citable and linked to and from other publications. We anticipate using an open text indexing system that leverages search engine optimization techniques rather than traditional metadata indexing. The ICR generates a substantial body of original text statements, associated directly with known published articles and their links (DOIs), which magnifies context and improves the findability of the ICR publication. For example, when scholars interested in an author's work performs an open web search on author name, and that author's work is referenced and discussed in an ICR, the high number of links and text references will be expected to optimize its ranking in current search algorithms. Unlike traditional or even online journals, the full text of an ICR publication will be completely issue-focused, leading researchers investigating that issue online to easily produce the ICR publication, and increasing its value as a timely and perhaps newsworthy review publication.

4.   Conclusion

Despite continual advances in technology, the cognitive task of identifying and locating candidate artefacts appropriate for consideration in problem-centered reviews remains daunting. We propose that by building a network of many-to-many human relevancy candidate artefacts and facilitating their evaluations we can surpass the limitations of computer-based algorithms to create a meaningfulrelevancy maps of information artefacts that are germane and useful with respect to important interdisciplinary [1,3] problems. People faced with a need to understand a particular issue or academic question often use various search techniques to identify electronically accessible information sources that may be relevant for constructing a mental model of an issue. Search engines use various retrieval algorithms to automatically rank the likely relevance of the information artefact to the matter at hand. The user than scans through retrieved lists and makes their own assessment. This works well for simple matters and can also be used to systematically identify

all papers on a new or proscribed topic [11]. But for more complex information problems where multiple perspectives of relevancy are apparent, it is becomes more difficult to find problem-relevant materials or to develop a guide to an emerging or dynamic literature. We propose that a hybrid system of informatics algorithms and human assessment of relevancy linked to the specific contexts and multiple perspectives may increase the societal utility of navigating electronically accessible collections of information sources.

Gonzalez et al [37] have attempted to evaluate the quality of digital libraries and identifies the pertinence and relevance of elements in these collections as key quality dimensions. They distinguish between pertinence and relevance with respect to where the relation between a document (text) and information need (query) sits. For pertinence or more specifically cognitive relevance, the relation is perceived in the mind of the user of the digital library. General relevance on the other hand, or more specifically systemic relevance, describe that relation as being an objective, publicly, and social notion that can be established by general consensus.   It is this public assessment of relevance that we are interested in. However we recognize the need to engage a wide spectrum of perspectives and worldviews in order to establish a recognizable and widely acceptable consensus.

We believe that attempts to map out relevance relationships and attempts to engage in ¨genuine dialogue¨ have many elements in common.   We want to learn from what has been proposed in the past about engaging in genuine dialogue to develop a means by which a community can work together to create public knowledge about "a matter at hand" where the purpose of the dialogue is to create a shareable cognitive map of the relationships that define that problem.   We propose that the principles of dialogical inquiry can be applied to facilitate this public and socially situated process. The dialogical process can be used to discover as a group what the information sources relevant to a particular topic, how that relevancy is coloured by ways in which the information was produced and the situations in which it can be applied and finally how that assessment of relevance is motivated by a need or an intention to complete a particular task.

The theory and conceptualizations described above are being used to constrain and guide design of online platforms that will enable participants to track and reveal the processes they use to evaluate the pooled information artefacts associated with the reports and reviews. This draws out tacit knowing, by requiring participants to recognize and state the meaning value of knowledge they derive from the accessible information artefacts considered in the review. Furthermore, the process enables the explicit assignment of humanly-identified relevancy of those sources to a given problem, a relationship that can be preserved electronically and indexed so that external non-participants might locate the reviews as they seek information on similar problems to those indexed by ICR publications.

We believe that this feedback will generate new knowledge and represent a new form of scholarly activity which in turn will create a new media for reuse of published or otherwise accessible scholarly papers and findings. The syncopated nature of the information represented in the ICR products will resemble attempts by early 20th century authors like Joyce to deal with the ¨Gutenberg Galaxy¨ and produce " *syncopated manipulation to permit inclusive or simultaneous perception of a total and diversified field. Such, indeed, is symbolism by definition- a collocation, a parataxis of components representing insight by carefully established ratios, but without a point of view or lineal connection or sequential order"* [38, p. 267]. Following McLuhan we call this process a syncopated manipulation of accessible information. The process of ICR, driven by collaborative reflection and dialogical response, will reveal and accentuate weak beats in the information flow that resonate with the participants and be amplified into new and more transmissible learning and teachings.

5. References and Notes

[1]   A wicked problem is generally understood as an ill-defined, messy, circular problem that resists solution by logical analysis and planning. As originally defined by Rittel and Webber (3), wicked problems embody ten characteristics that distinguish them from "tame" problems. Many interdisciplinary research issues entail wicked problems, requiring the coordination of multiple disciplinary views.

[2]   HOFMEYER A, NEWTON M, and SCOTT C. Valuing the scholarship of integration and the scholarship of application in the academy for health sciences scholars: recommended methods, 2007, *Health Research Policy and Systems,* vol, 5, p. 5

[3]   RITTEL, H and WEBBER, MM. Dilemmas in a general theory of planning. 1973, *Policy Sciences*, vol. 4 (2), p. 155-169.

[4]   HEY, T, and TREFETHEN, A. "The Data Deluge: An e-Science Perspective," in Grid Computing: Making the Global Infrastructure a Reality. (Chichester: Wiley, 2003), pp. 809-24.

[5]   BROGMAN CL. Data disciplines and scholarly publishing, 2008, *Learned Publishing,* vol. 2, p. 29-38

[6]   DERVIN, B. On studying information seeking methodologically: the implications of connecting metatheory to method. 1999, *Information Processing and Management*, vol. 35, p. 727-750.

[7]   DERVIN, B. Libraries reaching out with health information to vulnerable populations: guidance from research on information seeking and use. 2005, *Journal of the Medical Library Association,* vol. *93*(4 Suppl): S74–S80.

[8]   KESELMAN A, LOGAN R, SMITH CA, LEROY G, and ZENG-TREITLER Q.   Developing informatics tools and strategies for consumer-centered health communication, 2008, *J. Am. Med. Inform. Assoc.* preprint published April 24, 2008; doi:10.1197/jamia.M2744

[9]   LYNCH, CA. The shape of the scientific article in the developing cyberinfrastructure, 2007 CT Watch Quarterly, vol. 3. Accessed 21 May 2008

[10]   DAVIS D, EVEANS M, JAHAD A, PERRIER L, RATHH D, SIBALD G, STRAUS S, RAPPOLT S, WOWK M ZWARENSTEIN M. The case for knowledge translation: Shortening the journey from evidence to effect. 2005 *British Medical Journal*, vol., 32, p. 33-35.

[11]   Editorial, Many reviews are systematic but some are more transparent and completely reported than others., 2007, *PLoS Medicine editorial,* vol. 4, p., e147.

[12]   TRICCO AC., TETZLAFF J, SAMPSON M, FERGUSSON D, COGO E, HORSLEY T, and MOHER D. Few systematic reviews exist documenting the extent of bias: a systematic review, 2008 *Journal of Clinical Epidemiology*, vol. p. 422-434.

[13]   MILES A, LOUGHLIN M, and POLYCHRONIS, A. Medicine and evidence: Knowledge and action in clinical practice. 2007, *Journal of Evaluation in Clinical Practice,* vol. 13, p. 481-50.

[14]   THOMAS, P. General medical practitioners need to be aware of the theories on which our work depends. 2006, *Annals of Internal Medicine,* vol. 4, p., 450-454

[15]   MAYOR S. Opening the lid on open access, 2008, *British Medical Journal*, vol. 336, p. 688-689.

[16]   LU Y. The human in human information acquisition: Understanding gatekeeping and proposing new directions in scholarship. 2007, *Library & Information Science Research*, vol. 29(1), p. 103-123.

[17]   National Library of Medicine, 2007,   HYPERLINK "http://www.nlm.nih.gov/pubs/factsheets/nlm.html"   HYPERLINK "http://www.nlm.nih.gov/pubs/factsheets/nlm.html"   http://www.nlm.nih.gov/pubs/factsheets/nlm.html

[18]   AMIN A, and ROBERTS J, Knowing in Action: Beyond Communities of Practice. 2008, Research Policy, vol. 37, p. 353-369.

[19]   THIEDE M. Information and access to health care: is there a role for trust. 2005, *Social Science & Medicine* vol. 6, p. 1452-62.

[20]   Relevance, *Oxford English Dictionary*, online. 2008, Oxford University Press

[21]   SARACEVIC T. Relevance: a review of and a framework for the thinking on the notion in information science. 1997, *Readings in information retrieval*. San Francisco: Morgan Kaufmann, p. 143 – 165.

[22]   SCHUTZ A. 1977, *Reflections on the problem of relevance*. New Haven, CT: Yale University Press.

[23]   WENGER E. 1998 . *Communities of practice: Learning, meaning, and identity*. Cambridge, UK: Cambridge University Press.

[24]   SPENDER JC. Method, philosophy, and imperics in KM and IC. 2006, *Journal of Intellectual Capital,* vol. 7 (1), 12-28.

[25]   MIZZARO S. Relevance: The whole history. 1997, *Journal of the American Society for Information Science,* 48: 810-832.

[26]   MARON ME. On indexing, retrieval, and the meaning of about. 1977, *Journal of the American Society for Information Science* vol. 28, p. 38-43.

[27]   SHORTLIFE EH and BLOIS MS THE COMPUTER MEETS MEDICINE AND BIOLOGY:EMERGENCE OF A DISCIPLINE, 2006, in *Biomedical Informatics Computer Applications in Health Care and Biomedicine* EH Shortliffe, editor, 3rd ed. New York: Springer-Verlag, (p. 24) http://www.dbmi.columbia.edu/shortliffe/Ch01.pdf

[28]   Collaborative, *Oxford English Dictionary*, online. 2008, Oxford University Press

[29]   PENNEFATHER P. and SUHANIC W. Diagnostics. *Laboratory for Collaborative Diagnostics,* www.lcd.utoronto.ca

[30]   BLOOM BS. 1956, Taxonomy of Educational Objectives. Handbook 1: Cognitive Domain. New York: David McKay

[31]   SCHREIBMAN V. and CHRISTAKIS AN. New Agoras: New geometry of languaging and new technology of democracy: The structured design dialogue process. 2007, *International Journal of Applied Systemic Studies,* vol. 1, p. 15-31

[32]   Knowledge Translation, 2007, *CIHR*, http://www.cihr-irsc.gc.ca/e/29418.html

[33]   UNESCO. (2008). Retrieved from AIMS and Literacy Assessment, UNESCO Bangkok website http://www.unescobkk.org/index.php?id=3749" on 22 May, 2008.

[34]   NONAKA I. A dynamic theory of organizational knowledge creation. 1994, *Organization Science,* vol. 5, p. 14–37.

[35]   POLANYI M. (1966). *The Tacit Dimension*. New York: Anchor Day.

[36]   SUMNER T. and BUCKINGHAM-SHUM S. From documents to discourse: Shifting conceptions of scholarly publishing. 1998, *Proc. CHI 98: Human Factors in Computing Systems*, 18-23 April, 1998, Los Angeles, CA. ACM Press: New York.

[37]   GONZALES MA, MORIERA BL, FOX EA, and WATSON LT. What is a good digital library: A quality model for digital libraries. 2007, *Information processing and Management* vol. 43, p. 1416-1437.

[38]   MCLUHAN M. 1962, *The Gutenberg galaxy: The making of typographic man*. Toronto: University of Toronto Press. (p. 267)