

Designing to Support the Social Aesthetics of Inquiry

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Abstract. This paper addresses the design of socially centered tools to support Arts and Humanities PhD students in their inquiries. We discuss the limitations of current products and describe our research of PhD students. Drawing on the work of the philosopher John Dewey, we find that inquiry is a characteristic activity of the members of an academic field. Inquiry as a shared human endeavor has aesthetic qualities that direct students. These aesthetic qualities manifest in social interaction and the material products of inquiry. We suggest that the fractured experiences associated with current inquiry-supporting tools can be avoided by designing from an understanding of the underlying aesthetics of inquiry. A product concept designed from this perspective is presented.

1 Introduction

This paper reports on a design research project undertaken at Carnegie Mellon University as part of thesis work towards a Masters degree in design. In this project we propose a digital product that works to support the broad social process of inquiry in contrast to current technology that supports isolated informational tasks. We arrive at this product after conducting design research in which we investigate the tasks, activities and situations through which PhD students in the Arts and Humanities undertake their inquiries. We also draw on the work of the philosopher John Dewey to inform our understanding of inquiry and the role of its aesthetic qualities in the functioning of the activity.

During our research a humanities professor told us that what he looked for when selecting candidates to join his PhD program was not so much a technical capability but a sense of beauty and anger. He explained that he was seeking in prospective students a constructive anger that takes issue with the way that a discipline views and works with its subject matter. He also looked for a sense of beauty that admires expression in compelling theory of researchers' engagements with their worlds.

The world of the PhD student in the Arts and Humanities conjures visions of books old and radical, conferences, feuds and coffee shops, introspection and discovery, all in the pursuit of academic inquiry. Beyond this brown-edged aura, what is actually happening in inquiry is poorly grasped—poorly grasped by students as they live it, and poorly served by those who design technology and software to support it.

Doctoral students are charged with the creation of new knowledge, with making and articulating discoveries in the world. Mechanical connections between resources are important, but new knowledge in the Arts and Humanities is not typically found through connecting the dots of what is already known. New knowledge arises through inventive interactions in problematic contexts. A disciplinary community shares to a degree the problematic context with the student, but the act of unique invention and discovery out of that context belongs to the individual students. What makes a discipline a social group is a generally shared subject matter and a common endeavor undertaken by each of member of the group to create specific new knowledge. Beyond the particularity of a student's topic, that endeavor proceeds through inquiry.

Inquiry is often reduced to a normative methodology—a formalizing of practice. In the Arts and Humanities, inquiry proceeds through the resolution of a problematic situation [5]. The resolution, and the path taken to it, is as unique as the situation itself. Inquiry is conducted on ground that continues to shift as the inquiry proceeds. Past practice is informative, but the quality of working on shifting ground is pervasive. This quality is aesthetic, it colors experience and manifests in beauty, anger, fulfillment, and uncertainty. Beyond the correct employment of methodological technique, mastering the aesthetics of inquiry is the challenge facing PhD students in the Arts and Humanities, a point echoed by John Seely-Brown in relation to higher education [3]:

“But the last two years of undergraduate, and surely graduate, education have more to do with the intensive learning, which involves enculturation into a particular practice. More generally, the sense of acquiring the aesthetics of a practice as well as the practice itself is part of intensive learning.”

Making sense of a broad and problematic world is the charge of the PhD student. It is difficult work, at times crushingly frustrating, at others fervently rewarding. For the new student the quantity of information and ideas are overwhelming. Janson et al [9] describe the emotional challenge—the feelings of isolation and self-doubt—that are common for PhD students as they venture within new terrain. It is an important step for students that they recognize that they are not struggling alone, but as part of a community—a heritage of scholars sharing a disciplinary interest and practice. Working within a community allows the student to make sense of material and experiences through the practices, history, and personalities of their field. Technologies that treat information resources as self-contained packets are unsupportive of the social development of learning.

Etienne Wenger [16] describes people learning and working in organizational contexts through participation in communities of practice rather than by individual refer-

ence to a formalized body of information. These communities form around shared activities and work to support both the conduct of the activity and the people within the community. Learning that occurs within communities of practice goes beyond that explicitly bound in text or formal procedures. In their book *The Social Life of Information* [3], John Seely-Brown and Paul Duguid reveal information to be more than an accumulation of material fact. They suggest that its usefulness arises in the way that information mediates relationships between people and allows them to act within a fundamentally social world.

Much of the shared activity of academic communities manifests as text, but often this information is conceived of within current digital information tools as a self-sufficient parcel of knowledge rather than as a social product and resource. Increasingly we see scholarly databases making “social” connections between publications, for example listing the references that other texts make to a publication, or revealing an author’s associates. This is a move towards being explicit about the social connections within a field. These connections are useful pieces of information that take on meaning within the community context of the field. There is, however, a mechanical quality to this connection that does not speak to the beauty that the humanities professor saw in students’ inquiries.

Recently Paul Dourish [6] questioned the notion of social software. His point is that all software is inherently social as it is inescapably employed within a social and cultural context. To illustrate his point he describes the social nature of Microsoft Word

“For instance, in writing this position, I am (1) oriented towards an audience, (2) working within established genres, (3) drawing on the work of others, and (4) embedding my narrative within a particular disciplinary position. All while using Word.”

We agree with Dourish that software is always socially employed. However, the conception of the use of most information software, and of the products created within it, is material rather than social at the point of its design. This focus on the material aspects of information works against the building of relationships across resources and the building of community.

We suggest that there is an opportunity to design digital socially situated products to support academic inquiry. We further suggest that when designing these products designers focus on supporting interactions with the materials of the social group, the interactions of the members within the group, and the shared activity that is characteristic of the social group. Current desktop and web applications address, albeit in a fragmented way, interactions with materials and individuals of social groups. The shared activity of inquiry that is core to the identity of the group is unaddressed by current products. Supporting inquiry as a core practice of a social group is important to bringing unity and pleasurable experience to products designed to support academic inquiry. Inquiry has aesthetic qualities; these qualities aid students in inquiry. We believe that products designed to work with the aesthetics of inquiry will manifest

benefits in pleasurable interactions between members of an academic community and in a beauty present in the writings of its members.

2 Research Participants

To focus our investigation we chose to investigate inquiry as undertaken by PhD students in the Arts and Humanities. We interviewed and observed the working conditions and activities of six PhD students, three of the students came from English, two from Design, and one from History. Additionally we spoke with faculty advisors to PhD students and academic librarians. All of the students were following a similarly structured program within the university. All students expected PhD studies to take from five to seven years to complete, during which time their studies were divided into the following phases.

1. The Comprehensive Phase (approximately 2 years): During this phase students take classes in the university within their broad area of interest. During this time their final research area is vaguely formulated. This phase is an exploration of past studies in the field, and a chance to survey opportunities for original work. This phase culminates in the comprehensive exam that establishes the student competency in the field, and their readiness to proceed to original research.

2. The Proposal Phase (approximately 1 year): During this phase students seek to clarify the problem that they wish to research. This involves an in-depth review of past work and the initial formulation of an original problem and hypothesis and the means for investigating it.

3. The Dissertation Phase (2-4 years): During this time students conduct original research into their problem area and extensively write on their research findings and formulate new theory that will be offered back to the field.

Of the students that we worked with, three were in the dissertation phase, two the proposal phase, and one the comprehensive phase.

3 Methods of Research

To gather information, we performed contextual 1-on-1 interviews utilizing the following qualitative design research techniques:

1. Open-ended questioning focusing on the students understanding and perceptions of the PhD process overall, as well as the methods through which they conduct their research

2. Walkthrough exercise focused on the tools and resources they use to perform their research activities (software; reading and research resources; techniques for studying, collecting, and recording pertinent information)

3. Identification of pain points in their research process and tools including work-around techniques

4. Workspace evaluation consisting of demonstrations of tools and utilities, techniques, and photo documentation of related resources

4 Participants' Experience of Inquiry

Three major themes emerged from our interactions with our research subjects

1. The activities of working with resources
2. The social space of inquiry
3. Inquiry as an environment

4.1 The activities of working with resources

For all our subjects the written word was the primary material resource with which they worked. These words came in books, in journal articles, in web pages, in email, in discussion list postings and as PDFs. The final product of their inquiries, their dissertation, would also be primarily textual. Many products exist that were designed to support text-based tasks. We looked at these products and at the context of their use.

1. Acquisition. The finding of text resources is perhaps the most visible of tasks in research. Tools such as internet search engines, journal databases, and library catalogs are frequently used by students both when locating a specific text and when conducting a broad survey of a subject area. These tools are able to return a multitude of resources based on search criteria. In talking with academic librarians we heard that many students, particularly less experienced researchers, have a “gotta find that one right book” attitude. This is based on an expectation that the answer to their problem of understanding is to be found encoded in a single document, and only awaits their discovery. Librarians commented that searching is seldom as simple as that. Often building an understanding that is useful to a researcher involves reading across and between texts to identify and place arguments—one against another. In spite of advances in the meta-tagging of resources and efforts like citation listings, search tools are still focused on pointing to texts in isolation. Search acts are also isolated in the sense that unless a student takes careful notes her search activities are lost when she closes the search application.

2. Managing. For all the students that we talked to, the issue of how to manage resources was a big concern. All but one felt that they were unsuccessful in managing the resources that they had or wanted to read. The one participant who had succeeded had done so by culling the resources that he would engage with down to a small pile of printed PDF documents. Digital tools such as Endnote (a personal bibliographic database) and computer directories were useful to a degree. But the challenge of managing a large volume of read and unread materials across a variety of formats (both physical and digital) daunted students. Filing systems struggled to cope with the volume and the uncertain relevance of resources. The changing meaning and usefulness

of a resource over time complicated this further for students. Additionally, resources buried in filing systems became somewhat invisible, requiring students to continue to cycle through resources previously read to reassess their contents.

Space was consistently used as an organizing principle for students. Students had a sense that a particular resource was on this shelf or was likely to be in that pile. A file sharing a place with others in a directory helped students identify the utility of a particular PDF.

3. Reading. Reading styles varied with the relevance of a resource. Papers that were of peripheral interest were often skimmed. Key texts were read in depth, often repeatedly over time. Students expressed a preference for reading from paper than from a screen. Reasons for this included the clarity of the printed page, the ease with which it can be repositioned while reading or laid out next to another text when reading across texts, and the ease with which it can be marked up or annotated by the reader. While preferring paper for reading, students appreciated the ability to carry thousands of pages of text digitally in their laptops, and hoped that future advances in screen resolution would improve the experience of reading text on-screen. Students interact with many different forms of digital texts: PDF, web sites, blogs, distribution lists, and personal emails. Different applications are used to interact with the various formats in which digital text is presented. For the student there are few convenient ways to connect or relate one source to another. Oftentimes students will print digital texts and handwrite connections that are important to other digital texts.

4. Annotating. Students typically created a lot of their own text while reading. This text might exist in the form of written notes, outlines or diagrams. The direct annotating of text through flagging, underling, highlighting and marginalia was very common. Texts read several times would often contain multiple sets of annotations within it. Generally, the more recent the annotation, the more relevant it was. While applications such as Adobe Acrobat possess the facility to annotate PDF documents, students felt that the effort required to produce and later review annotations in Acrobat was too demanding to be worthwhile.

5. Authoring. Students produce a great deal of text, either for their own or for community consumption, during their studies. The act of writing is often a process of clarifying and organizing thoughts. While offering features such as Track Changes, text authoring products such as Microsoft Word appear to operate under a model that sees the author as having a clear intent going into the act of writing; the word-processor serves only to capture and edit that intent. More typically writing involves the creation of a lot of text that, while useful in exploration, doesn't make it to the final text. Short of saving multiple versions, current software doesn't support well the exploratory and self-reflective aspects of writing.

4.2 The Social Activities of Inquiry

The problems associated with students' work with textual resources would largely be logistic were it not for the fact that students work as part of a community. It is within that community that the words contained in books and articles take on meaning and relevance. The romantic image of the noble scholar struggling alone and generating new knowledge in the world is contrary to the practice of students in modern universities. Students work with colleagues, faculty, and advisors within a university department. The department itself is situated within a discipline that has a history and membership distributed around the globe. Texts, so viewed, are not self-contained repositories of meaning; they are dialogs of the field, voices of practitioners, philosophies and epochs.

Undertaking doctoral studies marks a commitment to a discipline. The student becomes a member of a disciplinary community through participation in an ongoing dialog, sharing their discoveries and points of view. It is important to the student's development that she engages with the community. Students, particularly those early in their studies, feel apprehensive about engaging with other members of their community as they struggle to understand the breadth of the field of which they are now a part and how their interests fit in.

From a social perspective, the activities that seemed focused on resources take on a new dimension. Searching is no longer a matter of finding the right book; it involves a survey of the people of the field. Reading is engaging with the voices of others, and authoring is not the generation of text, it is contributing to a community. The nature of tools shifts as well. A database is not the student's only connection to a repertoire. Friends and colleagues become agents of research for the student. They keep their eyes open and point students to people and ideas that offer possibilities.

The students that we researched undertook various activities as part of their inquiries. Some actions were taken upon material resources, while some actions were social. After examining these activities we characterized them generally as activities to:

- Locate
- Engage
- Produce
- Connect

We recognized that while the social and material activities of locating, engaging, producing, and connecting would need to be supported in any product we developed; inquiry for our students was not a sequence of actions upon known subject matters. Inquiry for these students was an integrated undertaking through which the problem of their subject matter was developed and resolved. These students were emotionally bonded to their inquiries, and proceeded not through a series of activities reducible to separate tasks, but were guided into activity by the emerging character of their inquiries. The work showed them the way.

4.3 Inquiry as an Environment

There is a pervasive quality to inquiry as practiced by PhD students in the Arts and Humanities. As we went into students' homes and workplaces, and talked with them on a variety of occasions, we were struck by how they lived in commitment to their work. The problems that they wrestled with as they sought to develop new knowledge in their disciplines pervaded how they lived, and how they presented themselves. Their work, and their binding to it, has an aesthetic quality. The environing nature of inquiry motivated and guided students as they directed years to bringing a problem to clarity and developing a position that resolved it.

All of our subjects had a questioning attitude—they picked at the world. One of the students used the phrase “felt difficulty” to describe a sense that there was something missing in how her field saw the relationship of text and image. Out of the discomfort of this felt difficulty, her inquiry grew. As mentioned in the introduction to this paper, an advisor to PhD students told us that he looked for a sense of anger and beauty in candidates before accepting them to his program—anger as an energy to take apart a problem in the disciplines view of the world, and beauty to offer back something new and integral to the community. The same advisor repeatedly pushed his students to make him see “what’s new?” in their work and then pushed them to show him why it mattered, to answer the question “so what?”

5 A Model of Inquiry

Out of our research, we developed a model of inquiry as an integrated building activity. When we say that inquiry is a building activity, it is analogous to saying that a city is a building activity. A city is not built and then inhabited, the inhabitation of a city is its building. So too with inquires; they are built of inquiring. Their products are a state of finish at a point in time; the contents of that state are not predictable prior to its realization. The aesthetic qualities of inquiry persist throughout an inquiry's history. It is in support of these qualities that we suggest products that seek to assist inquiry should devote their efforts.

The model that we arrived at bears close resemblance to the way that the American philosopher John Dewey describes inquiry. In his book *Art as Experience* [4] inquiry is treated as an experience—an integrated and fulfilling undertaking. Dewey distinguishes inquiry from artistic experience on the basis of its intellectual materials, but recognizes that inquiries are permeated by aesthetic qualities common to all real experiences.

“This artistic structure may be immediately felt. In so far, it is esthetic. What is even more important is that not only is this quality a significant motive in undertaking intellectual inquiry and keeping it honest, but that no intellectual activity is an integral event (is an experience), unless it is rounded out with this quality. Without it

thinking is inconclusive. In short, esthetic cannot be sharply marked off from intellectual experience since the latter must bear an esthetic stamp to be itself complete.”

He further states:

“The most elaborate philosophic or scientific inquiry and the most ambitious industrial or political enterprise has, when its different ingredients constitute an integral experience, esthetic quality.”

Aesthetic qualities permeate profound human endeavors such as inquiry. Aesthetic qualities arise within vital interactions with a material world. The human lifeworld is in large part social, and sociality is a prime material of the aesthetics of human experiences—including inquiry.

“The material of esthetic experience in being human—human in connection with the nature of which it is a part—is social.”

In suggesting that the aesthetics of inquiry be supported in the design of products to assist PhD students, we are not suggesting that their inquiries be made into works of art, we are saying that there are aesthetic qualities in all inquiries that direct and emerge within the activity of inquiry. Products that are designed to be conducive to these qualities are more likely to assist practitioners of inquiry.

What then are the qualities of inquiries—the aesthetics of inquiry—that are common to the activity?

For Dewey this quality has three phases: the intellectual, the practical, and the emotional.

“It is not possible to divide in a vital experience the practical, emotional, and intellectual from one another and set the properties of one over against the characteristics of the others. The emotional phase binds parts together into a single whole; ‘intellectual’ simply names the fact that the experience has meaning; ‘practical’ indicates that the organism is interacting with events and objects which surround it.”

Figure 1 is the model that we formed from our research. In our model the characteristic aesthetic qualities of inquiry are order, belonging, and scaffolding. Order is the qualification of the undertaking of inquiry with meaning; belonging is the emotional binding of a work of inquiry to itself, its author, the community and discipline in which it arises; scaffold is the movement, the growth in response to the situated building, that pervades the inquiry. Together, the aesthetics of inquiry work to bring the problems of a student’s subject matter to resolution.

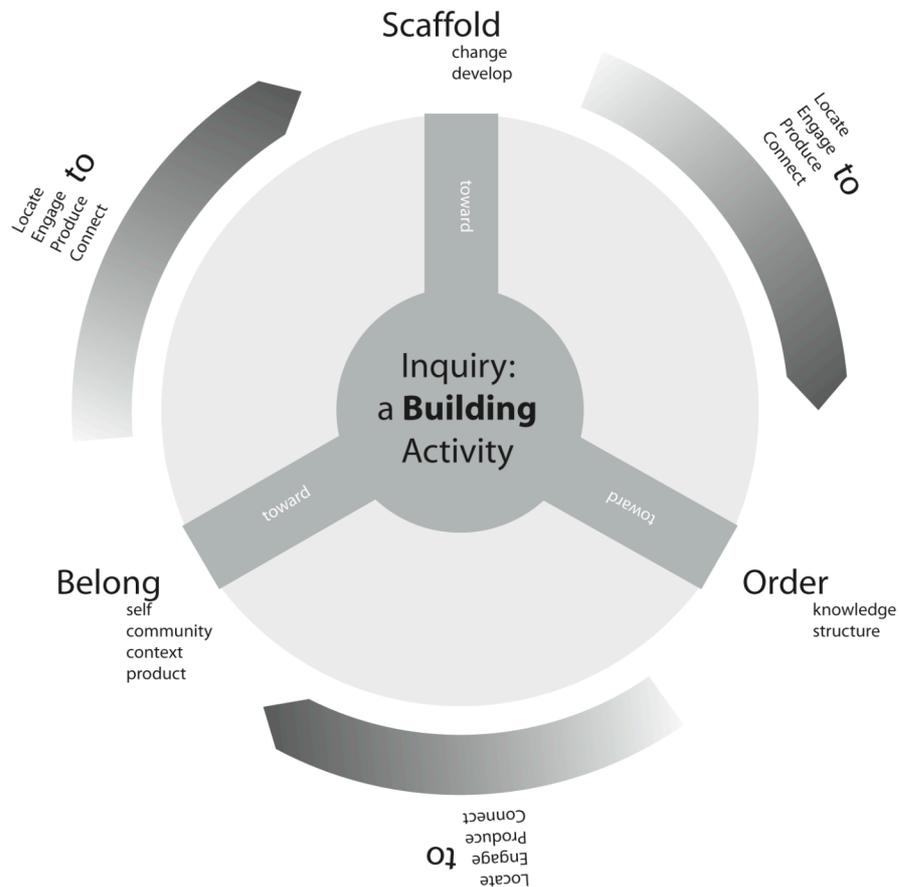


Fig. 1. Model of Inquiry.

We see the aesthetics of inquiries manifest in qualities associated with the activities of students. For example: In the ordering of quotes and annotations through which meanings in progress develop, in a student's constructive anger as she scaffolds off criticism and the constraints of the discipline, and in the beauty that develops as a student finds a belonging in their work and community.

These aesthetic qualities are the engine of inquiry. The actions of inquiry (locating, engaging, producing, and connecting) are merely its moving parts. These parts move in relation to the concerns of the environment in which the inquiry is directed. As Dewey [4,5] noted, this environment is primarily social. Locate, Engage, Produce, Connect refer in the first instance to actions that are social. When texts are conceived of as social products and resources, the same actions are applicable to textual material.

Aesthetic qualities permeate and condition the experience of inquiry. PhD students are not disinterested participants in the happening of inquiry. They push at it, and are pushed by it. It is a center of experience. Scaffold, order, and belonging are the grounding qualities of the endeavor to transform obscure situations to clarity. These qualities should not be viewed as by-products of inquiry—they are the conditions within which inquiry turns.

6 Building from the Model

We used the qualities of inquiry: *order*, *belonging* and *scaffold* as a ground on which to craft actions and material representations through which users would interact with the product. The core actions of *locate*, *engage*, *produce* and *connect* were supported within a range of tools. All of these actions worked to support the aesthetic qualities in which inquiry operates. Development proceeded through paper prototypes tested with users. A visual design language was developed to give the system a visual coherence. Strategies were developed out of our research to give the system a behavioral coherence in interaction.

These strategies are:

Spatial Organization. In our research we saw all of our participants making use of a spatial organization of materials in establishing a meaningful and dynamic order to their materials. This order might be reflected in the contents of specific shelves in a bookcase, or the relationships of printed PDFs in a manila folder, or the laying out of texts while they worked on writing a paper. The juxtaposition of materials one to another was not simply a matter of storage, but reflected a progression of work and a meaningful relationship of text to text. In the concepts for digital products that we suggest, we use spatial organization as a way for students to develop a changeable and meaning-carrying representation of the relationships of text to text—within the contexts in which they worked with them.

People Centered. There is a tendency to see texts as collections of words bound between covers or contained within a PDF. The students that we talked with were encouraged by their advisors to see texts as places of conversation with the authors that stand behind the words. People are modeled explicitly as objects within the digital products that we suggest. Bringing the authors to the fore as people, and not simply manufacturers of text, gives them a presence that facilitates an emotional engagement with authors as human beings, struggling through inquiry to make sense of the problems that concern them, just as our users are.

Contextualized Activity. The concepts that we developed treat the history of interactions taken with the system as a resource for establishing connections between textual materials. These connections are offered back to the user as a view into their work. The history of the development of activities is fully recorded within the system so that users can review how their work progressed. This is consistent with the idea

that the product of an inquiry represents a point of finish in a process. The activities leading up to that finish point themselves are capable of carrying a lot of meaning. Revealing them back to users offers the opportunity for reflective development.

7 inQUIRE: Our Proposed Product

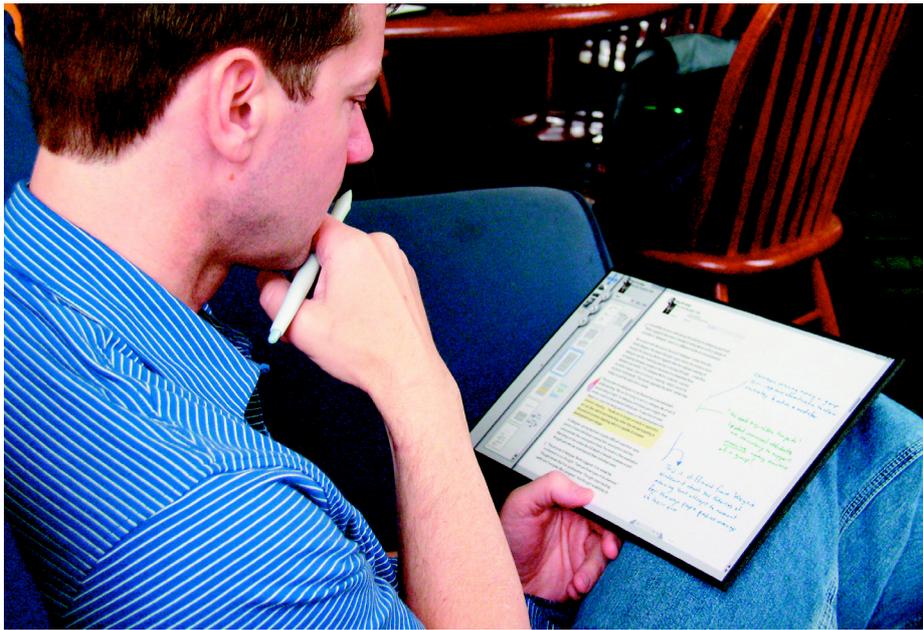


Fig. 2. Depiction of inQUIRE in use.

inQUIRE is a concept for an integrated digital environment designed to support the activities of students in the Arts and Humanities as they undertake inquiries within their doctoral studies. It is designed to run on existing technology on a tablet-based computer platform. Further improvement in display technology will enhance users' experience of the system. We anticipate that future users will benefit from multiple tablet displays and that improved display resolutions that will enhance the borderline readability of today's digital texts.

7.1 Activity Centered Spatial Organization

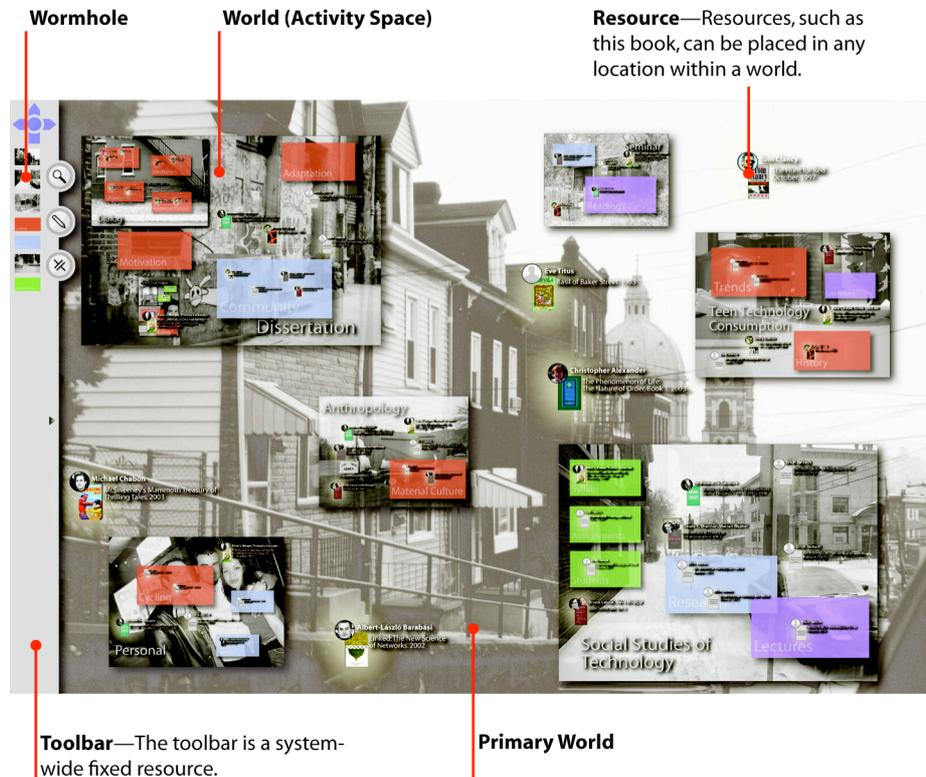


Fig. 3. Working spatially in the inQUIRE interface.

Within the inQUIRE system, resources are housed and ordered spatially by the user. inQUIRE forms a large digital space containing areas of activity and concern known as *worlds* or *activity spaces*. Each activity space is analogous to a desktop in the current computer metaphor. However, in inQUIRE, worlds are typically nested inside other worlds. The user is free to arrange the nesting and arrangement of activity spaces as she prefers. The appearance of each activity space is customizable. Customizing the appearance of activity spaces assists in the construction of a memorable and meaningful spatial order. The user engages with a particular world in the system by zooming in on it. Movement through the space is performed by means of zooming in and out, panning across the space, and through the use of *wormholes*—a type of spatial hyper-link built by the user to connect related worlds.

Each activity space is a place of interaction with the resources held inside it. These resources are digital files of any sort, but typically include annotated digital texts, student writings and web discussions as well as representations of people and events. Resources are displayed in user specified spatial relation to each other. In cases where

there are more resources than can be displayed, the system diminishes the size of less frequently referenced resources in a world, or moves to a list display format.

7.2 Reading and Reviewing Annotations

Resource Object—The resource object indicates which resource is currently active.

Personal Annotations—In this example the different colors correspond to different annotation made at different times.

The screenshot shows a digital reading interface for Peter M. Senge's 'The Fifth Discipline' (1990). The interface includes a sidebar with navigation icons, a main text area, and a right-hand panel for annotations. The text area contains several paragraphs of text, with some highlighted in yellow. The right-hand panel shows three handwritten annotations in different colors: blue, green, and purple. The blue annotation reads: 'Common meaning among a group is an important characteristic to allow technology to act as a mediator'. The green annotation reads: 'the whole organizes the parts' ↳ what communal attributes are necessary to support meaning among members of a group?. The purple annotation reads: 'This is different from Wenger's statement about the theories of meaning that attempt to account for the ways people produce meaning of their own'. The interface also features a 'Commentary Indicator' (a green bar) and a 'Highlighted Text' (yellow background) for the paragraph: 'The purpose of a dialogue is to go beyond any one individual's understanding. "We are not trying to win in a dialogue. We all win if we are doing it right." In dialogue, individuals gain insights that simply could not be achieved individually. "A new kind of mind begins to come into being which is based on the development of a common meaning. ... People are no longer primarily in opposition, nor can they said to be interacting, rather they are participating in this pool of common meaning, which is capable of constant development and change.' In dialogue, a group explores complex difficult issues from many points of view. Individuals suspend their assumptions but they communicate their assumptions freely. The result is a free exploration that brings to the surface the full depth of people's experience and thought, and yet can move beyond their individual views. "The purpose of dialogue," Bohm suggests, "is to reveal the incoherence in our thought." There are three types of incoherence.' "Thought denies that it is participative." "Thought stops tracking reality and "just goes, like a program," and thought establishes its

Commentary Indicator—Indicates that this paragraph contains commentary from the community. Green represents the quantity of books referring to this passage, red represents the quantity of articles referring to this passage, and purple represents the quantity of informal comments (distribution lists, bulletin board system postings, and blog entries).

Highlighted Text—Text that was highlighted by the reader is treated by the system as an annotation.

Annotation Timeline—This example indicates that three instances of annotations made at different time are currently being viewed. There are also indicators that two instances of annotations exist prior to and after this currently selected span of time.

Fig. 4. Reading and annotating.

inquire anticipates the wide availability of fully digital editions of books, made available to users through licensing or subscription. Within inQUIRE, users are free to markup or annotate these texts, as they do now with paper based editions. Addition-

ally users may insert links between passages from one book to another. In our research, we found that reading a text was an active process of making sense of what the author is saying, as well as constructing an understanding of how the author's position relates to others' and the student's own studies. Much of this process occurred through the annotating or highlighting of passages within texts. Students also told us that they read texts that are core to their inquiry many times over, adding new annotations each time they read it. Often times they are puzzled by earlier annotations that have little relationship to their later understandings of the text. An annotation timeline tool is provided within inQuire that users can use to review the history of annotation of the book, or filter out earlier annotations. Annotations are rendered in the page thumbnails used to navigate the book.

The digital text of the book is held on the web. In addition to the text of the book, users are able to see within the text the passages that have been quoted in other texts and articles. Also indicated are the passages that participants of online communities have written commentary on. This gives the user a quick indication of where the wider community has focused their attention within the publication.

7.3 Reviewing Community Commentary

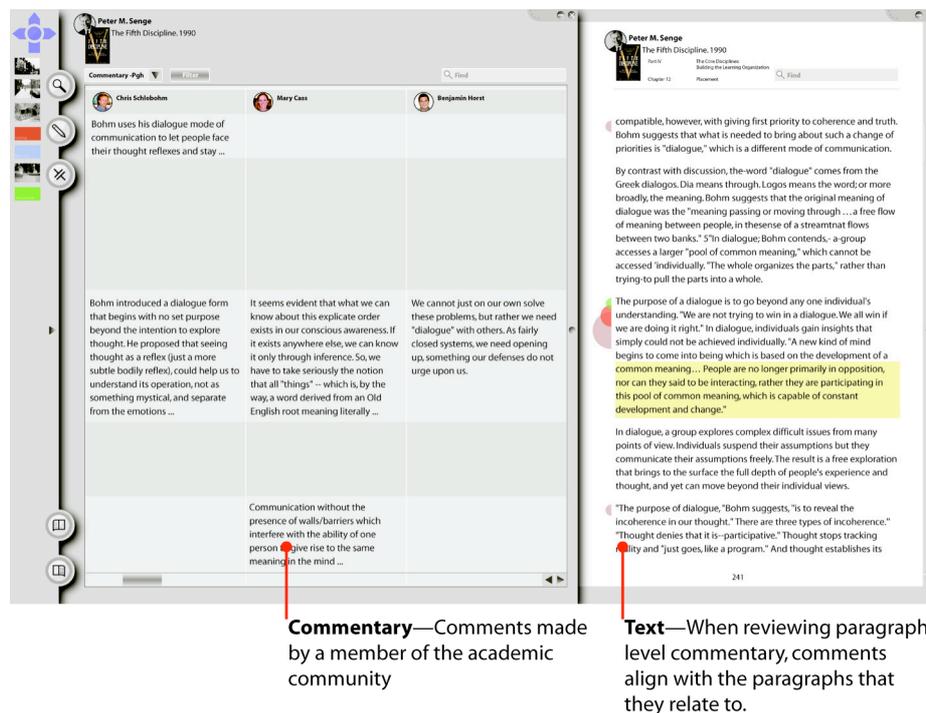
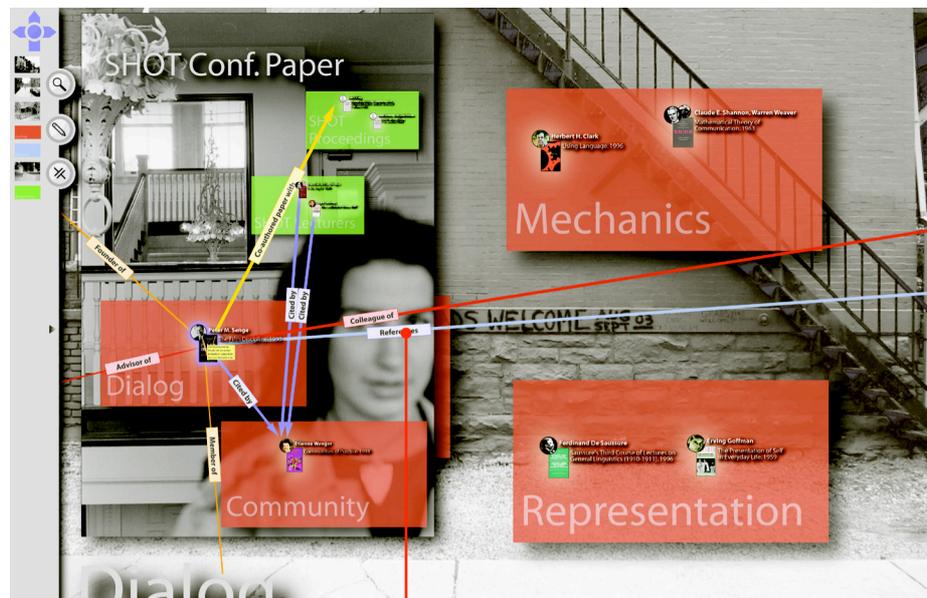


Fig. 5. Reviewing commentary on a text.

A text is a place of discussion between an author and the broader academic community of which the student is a member. The online publishing of texts allows the community to conduct discussions around the text. inQuire allows community members to offer commentary on a text at the publication, chapter, sub chapter and paragraph level. Users of inQuire can read and produce their own commentary on the text. When reviewing commentary, users can chose to filter comments, perhaps limiting comments to favored commentators or to recent comments from members of a particular organization.

It is a challenge, particularly for new PhD students, to recognize that they are part of a disciplinary community. inQuire intentionally exposes and encourages students to participate in that community.

7.4 Revealing Connections



Connection Identifier—When a connection between resources is identified by the system, a visual connection is made between the two and labeled.

Fig. 6. Revealing connections between people and resources.

Because resources represented within inQuire are richly modeled, the system is able to make and reveal connections between resources and their authors. For example, a user can ask the system to reveal connections around a resource and see that the author of the selected resource co-authored a paper with the author of another text in

the user's system, or that the author acted as an advisor to another author in the system. Utilizing the modeling of resources in terms of the personalities that stand behind them assists the user in understanding the social relationships that underlie the formation of knowledge within her discipline.

7.5 Producing Content

The screenshot displays the inQuire writing tool interface. On the left is a 'Source Check' sidebar with a search icon and a list of sources. The main window shows a document titled 'Technological Mediators, 2006' by Mark Samson. The document text discusses the relationship between individuals, objects, and other people, and the concept of dialog. Handwritten annotations in blue and green ink are visible on the right side of the page, including diagrams and notes. A red vertical line highlights a specific section of the text. A yellow callout box points to a citation for Erich Jantzen.

Source Check—The system monitors what is being written and reveals relationships to other peoples' work.

Writing Annotations—Annotations and links can be made in the document while writing.

Fig. 7. Exploration through writing.

There is much more to producing original academic writing than sequentially pressing keys on a keyboard and then editing the product. Many students use writing as a place of synthesis and discovery. While a student may have a topic on which they are writing and a sense of a structure for how the topic will be developed, the specific content and ideas that will be presented are often undiscovered until the student sits down to write. The writing tools within inQuire encourage exploration in writing. There is the facility for a student to annotate text that she has written and to create links to other resources. The student can also use the timeline tool to review the production of the text and take the text back to any point in its history. When the text is finally published, the author can choose to include the annotation and timeline data in the file, as material that other scholars can access. This gives the community the chance to read not only what the authors says, but gives insight on what the author was thinking as she wrote and reveals how the text developed.

The system also monitors the text as the author writes. If the user chooses it will present connections in real time between what the author is writing and other resources in the system. Uses for this include an automatic search for unknown related material, automatic construction of bibliographic references, and alerting the author to unintentional plagiarism in the way that she is presenting her ideas.

8 Reflection

inQuire is a concept for a system designed to support PhD students of the Arts & Humanities in their inquiries. Full working prototypes have not been developed, however in discussing animated scenario mockups of the system with current PhD students, they have expressed broad delight with the possibilities that they saw in the product, and with the way that it would sit with their processes of inquiry.

The practice of design has long been associated with the aesthetic realm. For much of its short professional life, design has been charged with attaching aesthetic qualities to objects to make them desirable. Interaction design arose out a view that recognized that pleasurable aesthetic qualities arise not solely out of the product itself, but out of the product in use—out of what people do with the product.

We are suggesting that there are aesthetic qualities present not only within the activities of people in product use, but that the broader endeavors in which humans take action have aesthetic qualities. Inquiry is such a human endeavor. As a mode of resolving the problems of the practical and intellectual world, inquiry has been practiced for centuries. Individual experiences of inquiry form upon a common human ground. As a ground, the essence of inquiry permeates the actions and materials upon it.

The aesthetic qualities of scaffold, order, and belonging that underpin inQuire, are not front-and-center like a splash of red. They operate quietly but forcefully, enabling coherence and purpose in individual experiences in inquiry. Whether reading, writing, transforming what has been built, or locating people and their texts, the aesthetics of inquiry move the inquirer and the inquiry towards resolutions that are new, coherent and beautiful.

Each of the features of the inQuire system presented above could have been designed individually using established human-centered design methods to produce a product that is well suited to its core activities. Design languages could have been utilized to pull these separate instruments into a coherent family of tools. In fact both of these strategies were used in our process. If we had stopped there we would have as a product a well-rounded suite of tools available as instruments of use when conducting activities of inquiry. By pushing beyond the activities of our users to the qualities of the shared human ground on which these actions are taken, we hope to shift the product from an instrument that is pleasurable in use, to one where the beauty of the

common human endeavor permeates the tool and naturalizes it and its use, within particular material and social worlds.

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