Working With Activity Theory: Context, Technology, and Information Behavior

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Over the last 7 years, the AIMTech Research Group in the University of Leeds has used cultural-historical activity theory (CHAT) to inform a range of research activities in the fields of information behavior and information systems. In this article, we identify certain openings and theoretical challenges in the field of information behavior, which sparked our initial interest in CHAT: context, technology, and the link between practice and policy. We demonstrate the relevance of CHAT in studying information behavior and addressing the identified openings and argue that by providing a framework and hierarchy of activity-action-operation and semantic tools, CHAT is able to overcome many of the uncertainties concerning information behavior research. In particular, CHAT provides researchers a theoretical lens to account for context and activity mediation and, by doing so, can increase the significance of information behavior research to practice. In undertaking this endeavour, we have relied on literature from the fields of information science and others where CHAT is employed. We provide a detailed description of how CHAT may be applied to information behavior and account for the concepts we see as relevant to its study.

Information Behavior

In 2002, the AIMTech research group in University of Leeds was formed with the broad aims of focusing on the interaction among information behavior, technology, organizational adaptation, and change. Although projects were undertaken in a variety of contexts and environments (from offshore oil rigs to women's refuges), a common strand,

which unified research and practice within the group, was the use of cultural-historical activity theory (CHAT) as a theoretical lens. In this article, we outline our motivation for using activity theory and the potential utility of the theory for understanding information behavior.

The term "information behavior" was coined by Wilson to cover all aspects of information-related activity, which was originally referred to in the ARIST literature (1966–1980) as "user needs" or "information needs" research, until Wilson (1981) suggested the term "information-seeking behavior." Later, Wilson argued that "information behavior" would be more appropriate as a broader term. Wilson's (2000) widely accepted definition describes information behavior as "the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use" (p. 46). Pettigrew, Fidel, and Bruce's (2001, p. 44) definition, "the study of how people need, seek, give and use information in different contexts, including the workplace and everyday living" is approximately consistent with this. These generalized definitions encompass the active seeking and purposeful retrieval of information, as well as the passive exposure or chance encountering of information. They include an array of interactions with formal sources of information such as library collections, written documents, or information systems as well as interactions with informal sources such as conversations and observations (Case, 2006). Therefore, the concept of information behavior is not limited to scenarios when the intention of the information recipient is to implement the new information in immediate action or to otherwise employ it in practice; rather it includes situations of nonconsequential passive reception of information (Wilson, 2000). However, Savolainen (2007) argued that the team information behavior is largely used by researchers in an unreflective manner.

Much of the early information-seeking research focused on artefacts and venues of information seeking (such as libraries) and information sources, rather than the needs of an individual. A gradual shift took place in the 1970's as emphasis shifted to the individual "as a finder, creator, and user of information" (Case, 2002, p .6) and research branched out into more task-orientated and user-orientated investigations (Dervin & Nilan, 1986). This trend has continued, and both individual and society have come into focus, resulting in more attention to context and social influence, more effort to "get inside the head" of the seeker, more time spent with individual informants, and greater depth of description overall made possible through qualitative analysis (Case, 2006; Vakkari, 2008). Despite this shift in modus operandi, a number of theoretical questions remain unresolved and openings remain in the field of information-seeking and information behavior.

In this article, we focus our efforts on identifying certain openings and theoretical challenges in the field of information behavior. In particular, we concentrate on CHAT to demonstrate its relevance to the study of information behavior. We argue that by providing a framework and hierarchy of activity-action-operation and semantic toolkit, we are able to overcome many of the uncertainties in information behavior research. In undertaking this endeavour, we have relied on literature from the field of information science, and although we have distinguished between information behavior and information seeking, the literature we refer to in this article intersects both fields. Additionally, to highlight the relevance of CHAT, we have referenced literature spanning the fields of education, human development, human computer interaction (HCI), and others where CHAT is employed.

The structure of this article is as follows. It begins by identifying key areas or gaps in information behavior research that we believe could provide fruitful opportunities for development. Following this, a brief description of CHAT and its development is presented. We then focus on demonstrating the relevance of CHAT in information behavior research, using examples from the extant literature, and outline how CHAT may address the research areas we identified and provide further theoretical probabilities. In the final section, a synopsis of our main points is presented, focusing specifically on how CHAT can contribute to the study of information behavior. We close with some discussion on the limitations and concluding remarks.

Motivations and Openings

It has been argued that there has been a general "loosening of conceptual frames" in information research and a general weakening of theory (Vakkari, 2008). Difficulties concerning semantic interpretations, definitions and counter definitions, the relative absence of social context in studies, descriptive rather than explanatory output, and weak ties to practice and design are just some of the criticisms (Case, 2002; Vakkari, 2008). Vakkari (2008, Conclusions section, para. 8) notes that this could be seen as being linked to the epistemological shift towards qualitative methods for description, which

has "intensified the tendency of building loose conceptual frames and of focusing on individual behavior ignoring social context."

Nonetheless, the field has matured and some authors such as Pettigrew et al. (2001) have reasoned that "a unifying theoretical body is emerging that, beyond its strong, user-centred core, emphasises the contextual interplay of cognitive, social, cultural, organizational, effective and linguistic factors and asserts that information behavior phenomena are part of the human communicative process" (p. 67). Furthermore, a number of distinct established traditions and emerging tributaries of research have been established, providing clear conceptual frames for the study of information behavior. These can be categorized as the *behavioral, cognitive, social, physical, perceptive/affective,* and *multifaceted conceptual frameworks* (Pettigrew et al.) with an emerging realist perspective, although there is considerable intersection among these traditions. A comprehensive review of these traditions is beyond the scope of our exposition and is to be found in Case (2002), Järvelin and Wilson (2003), Pettigrew et al., and others.

Although the extant research has illuminated our understanding of information behavior phenomena, a number of gaps and theoretical openings have been noted. These range from a weak theorization of information technology, the treatment of context (Järvelin & Ingwersen, 2004; Johnson, 2009), power, decision making (Berryman, 2006), and a critical lack of focus on policy and practice, which raises questions about the *raison d'être* of information behavior research. For some time, information behavior authors have been calling for theorists to continue to enhance existing frameworks and derive new ones that account for emerging concepts (Pettigrew et al., 2001). Along these lines, researchers have argued that more meaningful research can be attainted only through a shift in theoretical orientation. Against the backdrop of the identified openings and appeals for theoretical shifts and more explanatory studies, in this article, we describe the relevance and value of CHAT to the study of information behavior. In particular, we provide a clear example of its use as a theoretical frame, which specifically focuses on social context, and we argue it could address some of the challenges in the field.

Openings: Ontological Tilting and Practice Turns

In this section, we focus on three distinct openings or areas for development that sparked our initial interest in the use of CHAT. The first is the need to provide theory that stands in the mid-point of "societist" or individualist perspectives on context. The second area is the need to provide alterative theoretical frameworks that address technology in information behavior. In this, we present the view that the interactions between material and social or agency and constraint should not be treated as oppositional dualities (tilting towards one or the other) but as dualisms. The third opening is the need to provide a language and models that will reconnect information behavior research with practice or policy and allow us to communicate in a common language with disciplines that focus on design and development of systems.

Context. Extending information research to context has been described as one of the key challenges for the field of human information behavior (Järvelin & Ingwersen, 2004), if not *the* critical issue in information behavior research (Johnson, 2009). Indeed, Johnson argues that an understanding of context could unlock influence on policy and the emancipation of users:

> Individuals can only shape contexts, thereby conceptualising their worlds, if they understand active ingredients of context and how they act upon them. In a pragmatic sense, there may be no richer area of study for individuals who desire to shape the world around them. . .so an understanding of our social contexts is key to developing appropriate policy solutions. (2009, p. 802)

The significance of this area to the field was signalled by the creation of the biannual conference Information Seeking in Context (where Dervin [1997] presented her seminal paper on context) and in a number of reviews of context (Courtright, 2007; Johnson, 2009). More recently, Savolainen (2009) presented a thoughtful review the concepts of Small Worlds and Information Grounds as contexts for everyday seeking and sharing. This interest is mirrored in related fields of research from HCI (Bradley & Dunlop, 2005) through to IT use (Mark & Poltrock, 2004). Within the field of information behavior, there have been number of attempts to categorize or deconstruct the concept (Savolainen, 2006). Johnson, for example, proposes three senses in which context is used: situational, contingency, and major frameworks for meaning systems or interpretation. Talja, Keso, and Pietilainen (1999) present two polarities of "objectified" and "interpretative" approaches to context while acknowledging that there are also "in-between approaches"; "approaches which are constructionist, but not explicitly social constructionist" (Talja et al., 1999, p. 759).

Although there seems to be general consensus on the need for research that is sensitive to context, there is a lack of consensus on what "context" comprises and how it influences information behavior (and, in turn, is influenced by it). This may be explained by a degree of ontological ambivalence or unconscious assumption of particular theoretical perspectives within traditions (Talja et al., 1999), or that the traditions start from opposing and contradictory ontological positions and so mean different things when they use the label context. This debate parallels work in other fields. Schatzki (2002, p. 60), for example, argues that although context is critically important to understanding social practices, it has become a "wand for empty gestures," which is marshalled by theorists; however, the modus operandi or identity is rarely investigated. Indeed, Schatzki's (2005) analysis of social ontology provides a particularly illuminating perspective. Schatzki (2005) presents "two camps": that of the individualists and societists. He argues that individualists hold that social phenomena can be both decomposed into and explained by the properties of individual people, while societists analyse and explain by reference to groups. Schatzki then presents his own concept of "sites of organisations" as a possible mid way. He argues that

the key element of site ontologies is that human coexistence inherently transpires as part of a context of a particular sort.

> Like societist ontologies, they immerse the relevant features of individuals in wider, distinctly social settings in the absence of which people with these features would not exist. Like individualist ontologies, however, they deny that the wider context in which these features exists fundamentally diverge in character from these features. (Schatzki, 2005, p. 469)

If his framing is applied to the field of information behavior, then we see a lack of research that provides an alternative position to either societist or individualist positions. In common with Schatzki, we advocate a search for a third way within our field and propose a social ontology that emphasizes the dualism of individualism and societism. It has motivated our desire to find theory that overcomes the dualities, which we believe paradigmatic closure enforced (Allen & Ellis, 1997, 1999).

Technology. Courtright (2007) in her review of context in information behavior research notes that technology has a "special place" within information behavior research. In the past, its place was defined primarily as an unseen actor on the periphery, acknowledged in the micro context of the user interaction with an application or element of a technological system, rather than the interaction between the system within a macro-context and information behavior. Indeed, the role of new technologies provide particular challenges to existing theoretical frames; for example, Savolainen notes that the theories based on place and, in particular, Chatman's concept of Small Worlds are challenged by the new mobile technologies:

> Moving around with a mobile phone or wireless Internet makes people less dependent on places characteristic of conventional information grounds. Because connections are to people and not to places, the technology affords the shift to a personalised, wireless world, with each person switching between ties and networks. (Savolainen, 2009, p. 44)

On a metatheoretical level, the enduring question of the materiality of technology and its role in shaping behavior is one that preoccupied us. Although there is a recognition that technology and organization arise at the intersection of material and social (Leonardi & Barley, 2008), this has been manifested in the information behavior and information retrieval fields as a call for context and seen in increased sharing of theory with reference disciplines (Cronin & Meho, 2008) and importation of social theory.

In the field of information retrieval, this seems to be manifested towards materialist and determinist views of technology by applying a unifying cognitive perspective (Ingwersen & Järvelin, 2005). In information behavior, it seems to have tilted towards relativist and voluntarist views by importing constructivist theories of technology. Cronin (2008), for example, notes there has been increased citation and use of theory from the fields of sociology of science and science and technology studies in social informatics and information science journals. This presents a strong "tilt"

towards relativism and voluntarism. In her detailed review of science and technology studies (STS) and information studies, Van House (2004), for example, notes:

> STS is concerned with technology-in-use. Technology does not exist apart from the meaning that it has for people. It is constituted in use. Its meanings vary across groups and over time. (p. 72)

Talja, Tuominen, and Savolainen (2005) note that constructivism is used routinely and "without much worry" within information science research, and Savolainen (2007) points to its use within information use studies. Leonardi and Barley (2008) argue that the generation of theoretical accounts that are able to handle the interaction between either material and social or agency and constraint have been problematic because they associate materialism with determinism and relativism with voluntarism. We see the need for a theory that does not tilt and provides analysis of technology development that acknowledges both materiality and voluntarism. The turn to practice theory within the wider social sciences has been "a reaction against social constructivism and to re-establish the significance of material artefacts in the study of human behavior" (Miettinen, 2006, p. 390). Its introduction into information behavior (Savolainen, 2007) is a significant step within the field; however, its emphasis has not yet been on the reassertion of the significance of technological material artefacts. We feel that there is a pressing need for a theoretical framework that addresses the significance of material artefacts and provides a nuanced, contextualized understanding of their mediating role in information behavior. Like Miettinen, we sought theoretical openings, first experimenting with Dewey's Pragmatism via Strauss's Theory of Action (Strauss, 1993) in information strategy formation (Allen, 2000), and then in analyzing the implementation of technology and information behavior (Allen & Wilson, 2004). We then moved to activity theory, drawing upon the concept of Praxis, where human action is "neither the result of positivistic rationality subject to the limited contingency of a specific situation, nor as the irrational outcome of unlimited subjective interpretation, but as an epistemological process" (Han & Jones, 1994, p. 11).

Policy and practice. A final area of interest is on the impact of the research findings on the world outside our academic community. The influence or impact of our research on policy or practice has been described both as important and as a significant weakness to the development of our field (Dervin, 2003). Webber (2003) points out that it is a "sorry state" if the wider field of information science (which started) from practice is now of little relevance to practitioners, a point reinforced by Wilson (2008a). Up to this point, the debate about the "policy-practice" gap has remained largely "academic," with few sanctions or inducements in place to influence the actions of researchers. Recently, however, the issue of relevance to practice or policy has been brought into greater focus. In many countries, evaluation of research by those who fund our research and institutional structures has moved from traditional models, based only on journal ranking, citation

analysis, or income generation, to ones where the concept of "impact" now plays a significant place. In the United Kingdom, for example, the new proposed national model for evaluation of research excellence in universities now explicitly identifies that "in the Research Excellence Framework significant additional recognition will be given where high quality research has contributed to the economy, society, public policy, culture, the environment, international development or quality of life" (Grant et al. 2009). Equally, given the current financial climate and the expected pressure on both the availability of government research funds and the competition for them, it is not unreasonable to expect that nontraditional research sponsors from the private and public sector will play a much larger role in supporting research work: organizations that demand that research be relevant to their practice.

Although there are a number of ways in which information behavior work already does and could make an impact on policy development (Burnett & Jaeger, 2008), to the support of particular communities the one that perhaps provides the greatest opportunity for impact and where we are potentially weakest is that of systems design. Technological systems now mediate many of the behavior that we study and provide and there seems a strong opportunity for engagement in the design of new systems and technologies. Indeed, as the early 1980's potential for collaboration between systems designers and researchers in the field was noted by Rouse and Rouse (1984). Rouse and Rouse attempted to integrate concepts from human information behavior with systems design. Twenty years later Fidel and Pejtersen (2004) point out that very few studies in the field of information behavior have made an impact on the work of designers of systems, and Keshavarz (2008) asserts that they are rarely incorporated into real information retrieval systems. Approaches have been put forward to bridge the gap by providing new theoretical models, including systems modelling (Johnstone, Bonner, & Tate, 2004), Habermas's communicative action (Benoît, 2001), and cognitive work analysis (Fidel & Pejtersen). Others have attempted to integrate existing models into design such as Makri, Blandord, and Cox's (2008) use of Ellis' model. It is perhaps telling that the links between the information science and research community that serves systems developers is also weak. Ellis, Allen, and Wilson (1999) and Sawyer and Huang (2007) note that the research communities of information science and information system also remain fragmented with little cross-fertilization of ideas or communication. Järvelin and Ingwersen (2004, Goals of Information Seeking Section, para. 5) note:

> Supporting information management and information systems design may be the weakest contribution of information seeking so far ... the research results can not communicate to systems design, because the worlds do not touch.

The work of Cumlish and Malone (see http://designing socialinterfaces.com/patterns.wiki) in the field of information architecture tackles this issue by focusing on existing user behavior to design information systems, rather than
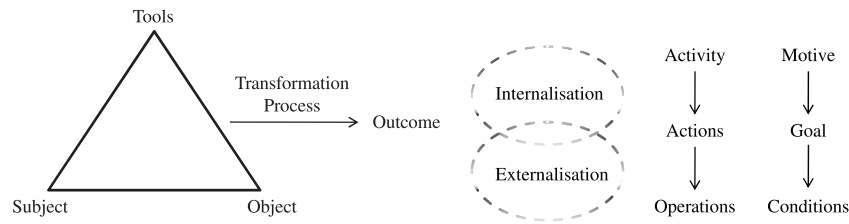
FIG. 1.   The basic structure of activity theory.

create an idealized design that ignores existing practices, geometry, ergonomics, and common sense.

The challenge for the field is to be able to provide research findings that are not "lost in translation" (Burton-West et al., 2005) or to find languages, theories, or models that are used in reference disciplines and can help inform both systems design and information behavior. Activity theory is recognized as theory that is highly applied (Ponomarenko, 2004) and allows links to practice particularly in the analysis of work, technology, and education (Rogers, 2008) as well as use in HCI (Bertelsen, Bødker, & John, 2003) and system design. As Miettinen (2006) notes that activity theory is an interventionist research approach with relevant concepts that are based on the dialogue between the researchers and the people they are studying.

A Brief Introduction to the Cultural Historical Viewpoint

Activity theory is based on the concepts of the cultural-historical school of Russian psychology. The main ideas of Russian cultural psychology were developed between 1920 and 1930, and they were centred on the unity of consciousness and activity. These ideas were an attempt by scholars to explain the interactions between human beings and the material world. Russian cultural psychologists recognized the coevolution of the human subject and the world itself. The human subject is social in nature, shaped by culture, and influenced by language, acting with or through other people in organizations, groups, and communities. The material world itself is social because the majority of the entities people interact with are other people and culturally produced artefacts. Therefore, Russian cultural psychologists understood the mind-forming interaction between human beings and the world in terms of culture and society. Lev Vygotsky, considered the founder of Russian cultural psychology, introduced many concepts that are widely used today, such as the zone of proximal development, cultural mediation, and natural and higher psychological functions.

Vygotsky emphasized the process of internalization and externalization and reasoned that these two basic processes operate continuously at every level of human activity. Internalization is related to the reproduction of culture (Engeström & Miettinen, 1999) or the internal reasoning and reconstruction of external objects (Xu, 2007), i.e., a child observes a pencil being used and learns to use it. The thought activity (e.g., reasoning and planning) is an important component of the internalization process (Leont'ev, 1978).

TABLE 1.   Description of the basic terms.

Activity: Not necessarily conscious, but may become conscious "WHY"	Governed by motive/ motives (Collective)
Actions: Conscious "WHAT"	Governed by goals (Individual or group)
Operations: Conscious when learned but can become unconscious or automatic in routine. "HOW"	Governed by conditions (Nonconscious)

Note. Adapted from "Activity Theory," In J.M. Caroll (Ed.), "HCI Models, Theories, and Frameworks: Towards An Interdisciplinary Science" (p. 301), 2003, San Francisco, Morgan Kaufmann.

Externalization is the process of the creation of new artefacts (Engeström & Miettinen, 1999), i.e., a child uses the pencil to draw a picture or to communicate his/her feelings. Internalization, far from being a single, clear-cut process, embodies a wide range of techniques that make mental life and activity more efficacious, i.e., thinking to oneself, reading to oneself, doing sums in one's mind (Toulmin, 1999). Humans not only internalize existing standards and rules of activity but also externalise them, creating new standards and rules (Lektorsky, 1999). Furthermore, internalization and externalization are highly integrated and continually iterating (Leont'ev).

Building on Vygotsky's work, Leont'ev introduced the concept of activity, a specific form of the societal existence of humans, which comprises the purposeful changing of natural and social reality (Davydov, 1999). Leont'ev distinguished between collective activity and action, reasoning that humans engage in goal-orientated actions that do not necessarily directly contribute to the attainment of the object of activity, mediated by tools. But eventually the actions lead to the satisfaction of a need (the motive) through the attainment of the object. Often, these actions make sense only in a social context of a shared work activity. Therefore, activities satisfy a need, and actions constitute the activities. Using this reasoning, Leont'ev (1978) developed a basic structure and common language used with regard to human activity, as represented in Figure 1 and described in Table 1.

In addition to the hierarchical structure, activity theory is dynamic, in that it recognizes that activities, actions, and operations change over time. An activity is part of a wider network (of activity systems) and most often the outcome of another activity is not intended for the same collective which produces it, but to be "consumed" by some other collective in some other activity (Korpela, Soriyan, & Olufokunbi, 2000).
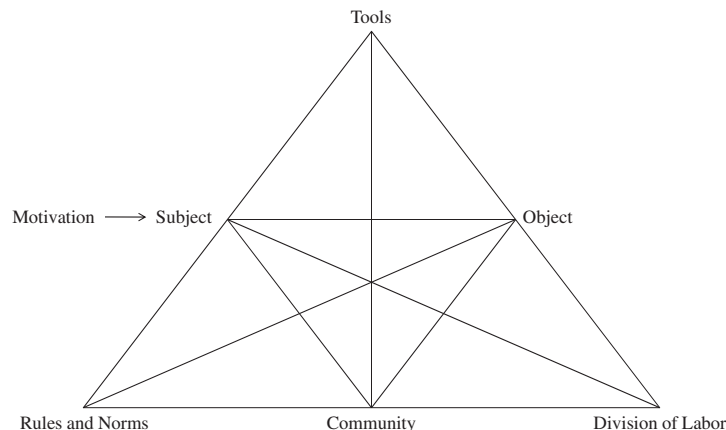
FIG. 2.   The activity system, adapted from Engeström (1987).

Moreover, the three levels of activity are not fixed—activities that exist at one time may become actions or operations at a later time; likewise an action can become an operation through internalization, and an operation can become an action through externalization (Bødker, 1991; Leont'ev, 1978; see Figure 1).

Recent generations of activity theory have maintained the foundations of the cultural-historical perspective, emphasizing the social aspects of activity and reflecting the societal viewpoint with the meanings of social situations and the dialogues occurring within them. Engeström (1987) expanded the activity system to include other elements such as community, the division of labor, and rules/norms (see Figure 2). By expanding the activity system, Engeström sought to call attention to the larger social context by adding in the community as a separate component and argued that the relationship between various aspects of the model is mediated in different ways. The graphical representation of the activity system illustrates that a subject, driven by a motivation to achieve an object, undertakes an activity. This process is mediated by tools and signs in collaboration with the community. Tools are physical artefacts, while signs refer to language, memory, skills and so forth (the word tools is almost exclusively used in the literature to refer to both physical artefacts and signs). This process of activity takes place against the backdrop of rules and behavioral norms and a division of labor. Tolman (1999) reasons that the division of labor in human society is the most obvious indicator of the individual human societal nature. Taking the activity as a unit of analysis the researcher constructs the activity system as if looking at it from above. At the same time, the researcher selects a member (or multiple members) of the local activity, through whose eyes and interpretations the activity is constructed. The reasoning between the overall and subject view brings the researcher into direct dialogical relationship with the activity investigated (Engeström & Miettinen, 1999).

An important element of the activity system is that the activity is constantly developing as a result of contradictions, tensions, and instability, and the systemic needs of the community and subject. Examining the tensions and contradictions that exist in the activity system provide a lens

to understanding the development and change taking place within the activity (Engeström, 1987).

The Relevance of the Cultural-Historical Approach: CHAT in Information Behavior

In the foregoing sections, we provided an overview of the research traditions that are predominant in information behavior. As observed, although the use of these traditions in the extant research has contributed to our understanding of information behavior, we identified openings or areas not well accounted for, specifically the weak theorization of information technology, the treatment of context, and the impact on policy and practice. Here, we demonstrate the relevance of CHAT to the field of information behavior and illustrate how CHAT can account for the identified openings and act as a theoretical lens to information behavior. This has already been explored, to a significant extent, in Wilson's (2008b) review of the field, where he demonstrated the relevance of activity theory to research on information literacy and concluded by suggesting that the time may be opportune for the "expansive transformation" of the field of information science to embrace what is currently studied from a diversity of disciplinary viewpoints.

Flexible Structure for Information Behavior Analysis

CHAT allows us to analyze information behavior as a collective and individual process (see Figure 3). Taking the activity as the unit of analysis provides a hierarchical structure and framework for examining information behavior that affords researchers insight into the sequential process of information seeking and its underlying tools, within context. Further, as underscored in the previous section, using the notions of internalization and externalization we are able to observe the absorption of information the habituation of behavior into practice and the manifestation of these in the form of knowledge and skills.

To demonstrate this process, we provide a detailed example. In this example, a group of students are allocated the

Collective Activity–Formation of Assignment

Tools
Physical: Stationary, Computers, Communication devices, Library materials, Meeting space
Abstract: Experience, Preferences for topics, Competencies on different topics, Writing skills, Research skills, Project management skills

Subject
Group of students

Object
Completed assignment

Rules & Norms
Grading policy, Plagiarism policy, Library hours spent, Attendance

Community
University students, Lecturers, Teaching assistants, Library staff, Tutors, Support staff

Division of Labor

Individual Activity–Seeking Information

Tools
Physical: Textbooks, Library books, Electronic resources, Internet, Lectures notes
Abstract: Research skills, Writing skills, Experience

Subject
Individual student

Object
Completed assignment

Rules & Norms
Information seeking behavior

Community
Students in group

Division of Labor
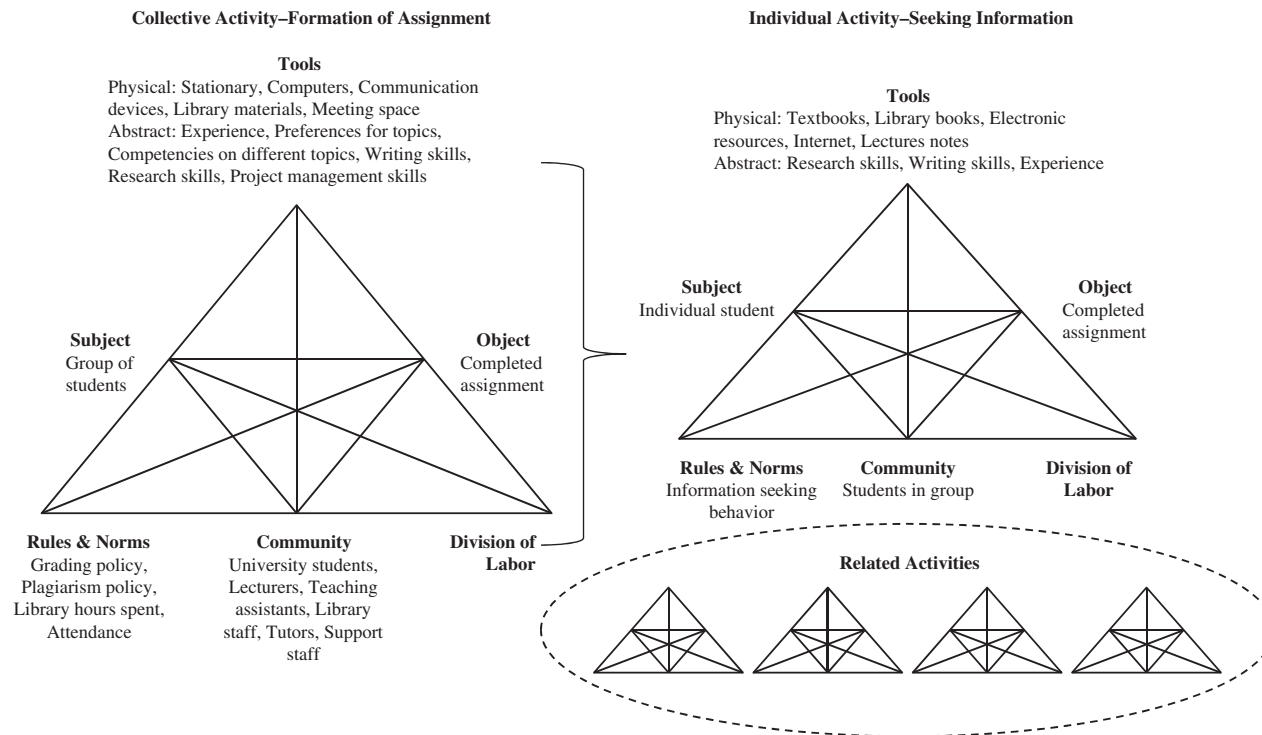
Related Activities

FIG. 3.   Collective and individual activity systems.

task of completing a group research assignment. The subject of the activity is, therefore, the *collective of students*, the activity is *the formation of the assignment,* and the object is the *production of the report,* which fulfils the assignment requirements, set out by the lecturer. The outcome is the report. Although the activity system provides an overarching snapshot of the activity, we can also distinguish between the collective activity and its constituent actions. Actions may become internalized and later become operations. For instance, the skills learned while searching for information and the information discovered may be internalized and may manifest in the form of automatic operations. Although this level of abstraction provides an overview of the activity and its context, it does not necessarily provide an in-depth analysis or explanation of the information behavior that has taken place. However, activity theory offers the flexibility in that within our example of the group research project, the actual individual information-seeking action can be conceptualized as a related activity on its own, thereby forming a specific information behavior unit of analysis. Within the individual activity, the subject becomes the *individual student* (rather than the collective of students), the activity is *seeking information*, and the object of his/her activity is *the information to be used within his/her assigned section of the project*. Figure 3 and Table 2 demonstrate the distinction between collective and individual activity systems and the related actions and operations.

By allowing for the drilling-down of the collective activity into the activities of group members, CHAT provides researchers with the opportunity to consider a deeper level of analysis of information behavior, in the context of an overarching activity. Furthermore, CHAT allows for the examination of activity, in which there is a combination of individuals who have merged as a group for a specific activity, such as group the students in the group assignment or other forms of work organization that do not fit the standard definition of team (Engeström, Engeström, & Vähäaho, 1999a). Engeström, Engeström, and Tarja (1999a) refer to this as "knotworking," characterized as the coming together (tying) and divergence (untying) of otherwise loosely connected actors and activity systems.

Motive, Object, and Information Needs

Activity theory takes motivated activity as the central unit of analysis, helping us to illuminate on the cause of information-seeking and information behavior. Within the behavioral literature on information research, the drivers for information seeking are recognized as "information needs," which are described as the recognition that an individual's (or collective) knowledge is inadequate to satisfy a goal (Case, 2002). However, there is little theoretical understanding of how these needs arise.

The cultural-historical perspective views human activities as the result of the linking of fundamental needs with the tools used for their fulfilment. Within our example of the group activity of preparing a project assignment, the object of the activity is the completed project report. In terms of motivation, the direct motive that induces the activity is the assignment outlined by the university lecturer. The role of the project assignment as a motive is consistent with the notion of an *information need.* Still, the direct motive does not

TABLE 2.   Collective and individual activity, actions, and operations.

	Collective activity		Individual activity	
Actions	Comprehend the assignment.	Actions	Initiation, selection, exploration, formulation, collection, presentation	
	Decide on a topic. Agree on a process. Divide work.			
	Work independently on the report. Prepare individual sections.			
	Search for relevant information.			
	Aggregate individual sections. Produce a draft.			
	Edit, finalize and submit the report.			
	Present the homework research project assignment.			
Operations	Initiation, selection, formulation, exploration, collection, presentation	Operations	Chaining browsing differentiating extracting verifying	

Note. Adapted from "Seeking Meaning: A Process Approach to Library and Information Services" (2nd ed.) by C.C. Kuhlthau, 2004, Westport, CT, Libraries Unlimited.

fully capture the motivation behind the information-seeking activity. Activity theory allows us to link the information need with the context within which the information is being used, or intended to be used. The information-seeking motivation of the students who complete the group assignment needs to be understood within the context of their university education and within the personal cultural-historical background of each of the participating students. These backgrounds carry the "fundamental needs" from which the information need and the ensuing information seeking behavior is derived. Depending on this background, individuals might view the assignment as an opportunity to achieve a high mark, to learn about new topics of interest, or as an opportunity to complete a degree requirement by means of free riding on the efforts of others. By using the concepts of motive and object, and the hierarchical structure of activity, activity theory allows us to understand information behavior within the context of the motives and how they arise.

Context

In the foregoing discussion, it was observed that the notion of context in information research remains broad and fluid. The cultural-historical perspective understands context as a dynamic and changing environmental variable. This is because context is viewed simultaneously as a byproduct and a determinant of history, embedded in action. That is, present context is a result of the social pressures of the past and past actions, giving rise to current practices and meanings, and it creates a cultural environment that impacts on the available courses of action for the future. Within the activity system, context is both internal (involving specific objects and goals) and, at the same time, external to people, involving artefacts, other people, and specific settings (Nardi, 1996c).

We are interested in contributing to the information behavior literature by developing an improved understanding of the context of information behavior. We reason that this can be achieved through the basis of the cultural-historical perspective, which views context as the legacy of past activities and as a determinant of present activities. Nonetheless, an inherent problem with defining context is that it is emergent, continually renegotiated and defined in the course of action (Dourish, 2004; Kuutti, 1999). CHAT, however, provides the scope to account for context that is relevant to the activity. We have already discussed how this can be achieved from the collective and individual activity perspective, understanding the emergence of the motive and object, and by employing the concepts of internalization and externalization. Additionally, examining rules and norms, community and division of labor in an activity provides further basis for accounting for context. This is done because rules and norms refer to the ever-changing explicit and implicit conventions that govern interactions between the subject and community and are useful for explaining embedded behavior. The community comprises individuals and groups, which are governed by a continuously refining explicit and implicit division of labor. The division of labor can be observed through the relationship between the community and the outcome. In the case of the group assignment, the context becomes the community (university students, library staff, etc.), the rules and norms (grading policy, library hours, etc.), the tools and signs employed (computers, research skills, preferences, etc.), the division of labor (who did what), and the relationship between these elements and the underlying cultural-historical influences. Against the backdrop of the motive and the object, we can obtain a clearer understanding of context.

Mediation

Earlier, we observed that there is a need for a theoretical framework that addresses the significance of artefacts. Activity theory provides a theoretical framework that accounts for material and abstract artefacts, which are central to concept of activity. These are instruments that both mediate and control human activities. These instruments are described as abstract tools and physical tools. Physical tools are material and mediate object-oriented activity, whereas signs are abstract and manifest in the form of language and mediate social intercourse. Tools are externally originated and are used in the transformation process, and signs are multifunctional tools

of communication and representation (Leiman, 1999). In our group assignment example, tools are suggested to be typical items such as computers, books, and so forth, but also abstract artefacts such as language.

It is important to recognize that mediation is an important element of the activity, in terms of the realization of the object, but more specifically in explaining the cultural-historical influences. This is because artefacts themselves have been created and transformed during the activity and "carry within themselves a particular culture—a historical residue of that development" (Kuutti, 1996, p. 26). Kuutti (1996) reasons that the "tool" is both enabling and limiting, because it allows the subject to achieve the object, but it also restricts the interaction, and because it is from the perspective of that particular tool or instrument (the tool has its historically collected experience).

We can use the concept of mediation to account for the role of tools, both physical and abstract, in determining information behavior. An important characteristic of CHAT is that it distinguishes and accounts for physical and abstract tools (refer to Figure 3). By focusing on internalization, we can shed light on how tools, information, and practices are appropriated and routinized. And by examining the physical tools used, we can understand why certain tools are chosen over others.

In most aspects of contemporary society, information technology has become the main mediating channel for seeking and accessing information, but the information research literature has only begun to address the issue of the role of technology in context as a mediating artefact in the search and acquisition of information. Furthermore, there is a paucity of research focusing on the choice among technologies. Employing an activity theory framework and the notion of mediation to the study of information behavior allows us to understand how people in need of information during the course of their activities choose between different channels and the underlying abstract processes for obtaining information.

Discussion on the Relevance of CHAT

In recent years, activity theory has been developed and shaped by scholars in a wide spectrum of fields, largely shedding its reputation as a Marxist perspective.[1] Now, activity theory is considered an approach that provides novel conceptual and semantic tools for tackling many of the theoretical and methodological questions that underpin the social sciences (Engeström, Miettinen, & Punamäki-Gitai, 1999b).

Activity theory has been applied in the fields of learning and teaching and HCI (Bertelsen & Bødker, 2003; Nardi, 1996b). However, increasingly it has been applied to information systems (Barki, Titah, & Boffo, 2007; Karanasios, Allen, & Vardaxoglou, 2009; Korpela et al., 2000; Vardaxoglou, Slavova, Allen, & Wilson, 2008).

Concerning information behavior, Wilson (2006, Abstract, para. 2) reasons that "the key elements of activity theory, Motivation, Goal, Activity, Tools, Object, Outcome, Rules, Community and Division of labor are all directly applicable to the conduct of information behavior research," arguing that activity theory is a powerful analytical tool and conceptual framework for enquiry. Spasser (1999) advocated its strength in accounting for context, its emphasis on practice and its rich heuristic vocabulary and conceptual framework, all of which contribute to the transferability and accumulation of knowledge.

Using activity as a unit of analysis we can explore information behavior within everyday life. The activity system includes a subjective actor (subject), motive, an objectified goal (object), physical and abstract tools for the accomplishment of the goal, and a community centred on the productive activity and mediated by rules, norms, and a division of labor. The use of the formalized activity system can contribute towards the development of the idea of a situation in information behavior research.

We demonstrated the relevance of CHAT to information behavior research. We began by establishing the utility of activity theory in understanding collective as well as individual activity, demonstrating its ability in accounting for information behavior at different levels of abstraction, in context. That is, it provides a framework for studying human activity practices at a multilevel, stratified manner (Spasser, 2002).

Activity theory also allows for exploration of the interaction between activity systems. In the group assignment example, this means that we can explore the interaction of the individual activities as they work towards the shared object. Or, we can explore the interaction of the collective activity in relation to other connected activities such as a parallel assignment.

Key to the relevance of activity theory is the level of abstraction the researcher selects. Engeström (1999) suggests that the historical units must be of manageable size. If the unit is the individual activity, then history is reduced to the individual's personal development (cultural-historical influences), and remains manageable. Likewise, if the unit is the collective activity, then the history goes beyond ontogeny, but remains tenable.

One of the greatest advantages of activity theory in information behavior is that it takes into account context (Spasser, 1999) and, by doing so, is able to address a major weakness in current information behavior research. By examining *rules and norms, tools, community,* and *division of labor,* researchers are afforded the prospect of understanding the cultural-historical influences. In other words, what takes place in the activity system is the context (Nardi, 1996c). Sharing many similarities with societist theory CHAT rejects the *isolated* human being as an adequate unit of analysis, focusing instead on cultural and technical mediation of human activity (Bertelsen & Bødker, 2003). At the same time, by offering the structure of activity-action-operations, it provides researchers with the opportunity to reduce activity into

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[1]Discussion on the Marxist origins and influence on activity theory have been omitted in this paper. See Leont'ev (1993) and Wilson (2008b).

its individual components. By doing so, it offers a mid-point between the individualist and societist perspective.

In addition, activity theory provides a hierarchical analysis of information behavior—activity-action-operation—and by doing so allows for the deconstruction of an activity. The distinction between collective, long-term activity, individual or group short-term action, and automatic, routinized operation and movement between the three is a core principle of activity theory (Engeström, 2000). This allows us to not only reduce information behavior in terms of actual observable behavior but also offer insight into the cognitive process through the notion of internalization and externalization. In the context of information behavior research, internalization can be thought of as the process of learning a practice or habituation (i.e., searching using specific tools) and/or the digestion of certain information. Externalization can be viewed as the manifestation of the learning practice or what we do with the information we have absorbed. Thus, activity theory is not restricted to examining only the behavior in regards to information practices, but rather it takes accounts for the cultural-historical context. This is a particularly powerful concept for information behavior research. However, while we know that internalization and externalization takes place, activity theory cannot inform us more than practice, information, and so forth are absorbed and later manifest, which we can observe. The actual cognitive processes remain beyond the grasp of activity theory. However, in applying activity theory to interactive information retrieval, Xu (2007) proposed a framework that offered an explanation of the mechanisms that govern the interaction between users' cognitive states and their manifested behavior when using an information retrieval system. Through his analysis, he showed that activity theory is suited to covering the diverse perspectives that were adopted in interactive information-seeking research and uncovering the complicated interactions among activity elements. Such interactions comprise both internalization and externalization processes and reveal the internal mechanisms that drive the dynamic transformation of a user's information need and seemingly chaotic query formulation behavior. Based on this research, Xu and Liu (2007) reasoned that the activity theory is useful in understanding the reciprocal effects between users' cognitive states and manifested behavior.

The notion of the artefact as mediator of human information behavior activity is central to CHAT. Understanding artefacts and the process of the accumulation of knowledge, can contribute to the cognitive viewpoint. The use of the mediation concept, and particularly the use of physical tools, can contribute to the behavioral tradition. The examination of mediation in information behavior may be particularly useful for explaining why certain sources and tools are used over others and the notion of mediation has been used in social science studies to facilitate design of information systems and understand the important tools in the process of design. Uden (2007) employed activity theory as a framework for describing the components of an activity system for the design of a mobile learning application, arguing that activity theory, as a social and cultural psychological theory, can be used to design a mobile learning environment and better understand distributed learning. In her study, activity theory was used to facilitate designers' understanding of the mechanisms through which social relations and material tools affected complex learning, and learners' interactions with others. Uden, Valderas, and Pastor (2008) reasoned that using the activity as a dynamic unit of analysis prevented simple causal explanation of mobile learning design by accounting for the institutional setting as a collection of multiple, systematically interacting elements, which include social rules, mediating artefacts, and division of labor. Concerning the mediation that takes place during innovation activity, Karanasios et al. (2009) used the concept of mediation to understand the pertinent tools during the process of innovation, but also to illuminate on the tools that were not used to understand how the innovation process could be enhanced.

Critical for impacting on practice, CHAT provides a conceptual framework and common language for engaging the information behavior (Spasser, 1999, 2002) and information systems and HCI research communities, while offering the opportunity to expand understanding of information behavior by clarifying language and expanding the boundaries by which we explore information behavior (Widén-Wulff & Davenport, 2007).

As underscored by Pettigrew et al. (2001), few frameworks offer suggestions for improving information systems beyond suggesting that they need to account for the information behavior tendencies of users. Activity theory arms researchers with a set of conceptual tools for analyzing and explaining, rather than only exploring information behavior. Using activity theory as an empirical framework, researchers and practitioners can better explain information behavior and employ this knowledge to improve or design efficient information systems. Kaptelinin and Nardi (2006) concluded that the application of activity theory makes a valuable contribution in areas involving complex systems. These include the design of systems with varying virtual and physical contexts such as mobile technologies and the design of technologies for an expanded set of activities such as technologies that are used beyond the work environment (at home and in everyday life). Activity theory is also useful to technology developers because it takes into account human experience in general, going beyond cognition to analyse the totality of action, reflection, and emotion.

One of the most instructive examples of activity theory that informs practice is the work of von Thaden (2007) on designing airplane cabins and training. von Thaden researched information behavior as it pertained to the behavior of flight crews that had accidents and those that had not. As a result, she suggested a framework that was modelled on information science, human factors, and activity theory research to assess the distribution of information actions, namely, information identification, gathering, and use by teams of users in a dynamic, safety critical environment. She argued that using activity theory in concert with an information behavior framework allows researchers to identify

weakness in the crew's performance and identify differences in crews who make errors to the point of an accident compared with those that do not. Importantly, this allowed her to make targeted improvements to train the crew appropriately or build more supportive infrastructure, thus hopefully defeating the chances of an accident in the future.

Therefore, given its ready applicability to technology development, activity theory carries the promise of bridging the gap between our understanding of how individuals or groups use the information services at their disposal, allowing for information services to be developed that are socially desirable, shaped to the information behavior of particular groups.

Conclusion

Although we have presented discourse concerning the relevance and advantages of CHAT to the field of information behavior, we do not contend that it is a remedy nor do we contend that it should be used to displace other frameworks; rather it can be used to treat some of the problems in information behavior research. We see CHAT as a lens that can illuminate three particular challenges that information science research faces: context, theorizing technology, and influencing policy and practice.

Nonetheless, we acknowledge that it comes attached with some limitations and hope that reflection and discussion of the criticisms will increase the self-consciousness of the tradition, as underscored by Bakhurst (2009). Linked to its Russian origins, there is underlying philosophical issues concerning the translation of the terms from Russian to English, and Backhurst (2009) claims that this has lead to confusion and arguments concerning the semantic interpretations of the terms activity and object. The concept of mediation, central to the concept of activity theory, imposes some limitations. This is especially true in information behavior and HCI studies where the study takes place against the backdrop of virtual realities and the boundaries between reality and tool become blurred (Kaptelinin, 1996), an issue that is likely to grow as we see growing convergence of work and social contexts with virtual realities and tools.

The extent to which activity theory can be used without also accepting Marxist theory in its entirety is also an issue of contention. Within our work, we have largely used activity theory as a lens without drawing upon its economic or societal analysis that would be seen as problematic by many within the activity theory research community:

> If activity theory is stripped of its historical analysis of contradictions of capitalism, the theory becomes either another management toolkit or another psychological approach without potential for radical transformations. (Engeström, 2008, p. 258)

As a research group, activity theory has provided AIMTech Research Group with a lens to view the world, a common vocabulary, and a set of tools. Part of our program has been to embrace both those who wish to use it as a management toolkit or approach (dislocating it from its historical analysis

of capitalism) and those who wish to use it as an emancipatory tool.

The research and literature that has informed the approach described in this article is borrowed predominately from the fields of HCI, education, and general activity theory, where the use of CHAT is continuously developing, yet is more mature. At present, there is a lack of clear operationalization in the field of information behavior concerning CHAT. Kaptelinin (1996) noted a similar problem in the field of HCI in the 1990s. Although this is perhaps typical among emergent theories, we have attempted to provide some clarity. To address some of the limitations concerning CHAT, researchers (von Thaden, 2007) have often employed CHAT in conjunction with other theoretical tools.

CHAT is an expansive framework that offers many concepts for studying social phenomena. In this article, we focused our efforts on particular aspects of CHAT to demonstrate its relevance in studying information behavior. By providing a conceptual framework and hierarchy of activity-action-operation and a set of semantic tools, we are able to overcome many of the uncertainties in information behavior research. As underscored by Nardi (1996a), activity theory provides a set of concepts for describing activity. However, we also showed that there is a lack of understanding about and limitations to the cultural-historical perspective. To overcome these limitations, we provided a description of how activity theory may be applied to information behavior and accounted for the concepts we see as relevant to its study.

Acknowledgments

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