

No Knowledge but through Information

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Abstract:

Why would we settle for data when we can have information? Or information when we can have knowledge? Discussions often reflect an implicit ordering of these terms: data < information < knowledge, i.e., information trumps data and knowledge trumps information. In a corporate/organizational context, information management came first as a field of inquiry, followed, beginning in the 1990s by discussions of knowledge management as a related but separate field of inquiry. And now, predictably, we have discussions of personal knowledge management (PKM), as a field of inquiry that relates to but is separate from personal information management (PIM). This chapter argues for the following statements: 1. Information is a thing to be handled and controlled; knowledge is not. 2. Knowledge can be managed only indirectly, through the management of information. 3. Personal knowledge management (PKM) is, therefore, best regarded as a subset of personal information management (PIM) – but a very useful subset addressing important issues that otherwise might be overlooked.

Introduction

What should personal knowledge management or PKM be about? What should personal information management or PIM be about? How should the two relate? As areas of study, should one subsume the other? Or should each be regarded as a separate area of inquiry? If so, where do areas overlap?

This chapter is about definitions. But the intent is not to arrive at formally “correct “ or even consensual definitions. Instead, focus is on useful definitions and the useful distinctions made by these definitions. Definitions for phrases like PKM and PIM are not “out there” awaiting our discovery. Rather, these definitions are for us to invent to serve our purpose.

What is this purpose? How will we know if definitions are useful? Useful is as useful does. Good definitions are a lens giving greater focus to our research and greater clarity in the interpretation of results. We seek to understand. But we also expect that better understanding leads eventually to greater utility.

We want to manage better. But management – whether management of information or knowledge or the detritus in a garage – is a means to an end. In companies, better management of information and knowledge should translate to various intermediate measures with enduring impact on the bottom line. Better management means better communication, better cooperation, better sharing of expertise so

that, for example, the working time of people in the company is angled more towards useful products and services and less towards the maintenance of bureaucratic routine.

At a personal level, we want to manage so that our resources – our money, energy, attention and, above all, our non-renewable time – are put to better use in accomplishing our life's goals, fulfilling our life's roles (as spouse, parent, friend, employee, etc.) and meeting our life's challenges (the challenge of raising a family, the challenge of a life-threatening disease, the challenge of old age).

This chapter argues for the following:

1. *Information is a thing ; knowledge is not.* Information as thing (Buckland, 1991) can be pointed to and experienced (or ignored). Information can take form in information items such documents or email messages, which can be modified, stored, retrieved, send, received, deleted and otherwise manipulated (Jones, 2007). Knowledge as “no thing” (Zins, 2007) cannot be experienced directly. Knowledge cannot be examined. Knowledge is imbedded. distributed. Knowledge is hidden. Knowledge is inferred through its impact on observable behaviors (information). Knowledge cannot be represented directly. All attempts to represent knowledge give us information in one form or another.
2. *There is no management of knowledge except through the management of information.* If knowledge lies hidden not to be experienced directly but rather to be inferred, then knowledge management must, to a large extent, be about its elicitation as information which can then be managed directly. Knowledge management also encompasses efforts to move in the other direction – from information to knowledge. For example, A company develops a new set of “best practices”. Knowledge management includes various uses of information aimed at effecting a change the attitudes and behavior of people within the company. Best practices are expressed not only in a formal document (which few will ever read) but also in posters displayed on cubicle dividers, in broadcast email announcements and in a film that employees are required to see as a group and discuss afterwards.
3. *PKM is a very useful subset of PIM.* Personal information management is a large area. How does a person – any of us – make use of information to accomplish a life's goals, fulfill la life's roles and meet a life's challenges? How – with better tools, techniques, training, policies, procedures, strategies, organizational schemes, etc. – might we do this better? Personal knowledge management as a subset of PIM gives additional focus. What do we know? Do we know what we think we know? Are we under-selling or over-selling ourselves? What should we be learning? How should we be learning so that the knowledge we need is integrated into our everyday lives? At the same time, PIM, as a superset of PKM, provides additional grounding. All of our feats of PKM will be accomplished, necessarily, through the use of information.

The remainder of the chapter will explore each statement in turn.

Information as thing ; knowledge is not

What's the difference between information and knowledge? The question endures. Zins (2007) describes the results of a survey of 57 respected experts in information science from 16 separate

countries. Each was asked to define the terms “data”, “information” and “knowledge”. Some participants asserted directly the ordering we often observe implicitly as in “Information is the end product of data processing. Knowledge is the end product of information processing.” (p 482). Others asserted that such an ordering is a “fairytale” (p 481).

Whether or not the ordering is correct, information would appear to play a pivotal role in efforts to understand both data and knowledge. In the Zins report, definitions for “data” and “information”, though distinct, frequently overlap. Likewise, definitions for “information” and “knowledge” overlap. For no participant, however, is there any evidence for an overlap between or confusion among the terms “data” and “knowledge”.

What is information? This question has been a repeated topic of discussion in its own right (Braman, 1989; Buckland, 1991, 1997; Capurro. R & Hjørland, 2003; Cornelius, 2002; Machlup, 1983). Buckland (1991), after an analysis of the many senses in which the word is used, concludes that “we are unable to say confidently of anything that it could not be information” (p 256).

Indeed, the efforts people make to understand their world are usefully characterized as acts of information processing (e.g., Broadbent, 1958). According to this view, our intelligence comes from our ability to process the raw data received through our senses into concepts, patterns, and implications. Everything “out there” that we are able to perceive is potential information.

Whether sensory data actually yields information depends. The seminal work of Shannon (Shannon, 1948) and Shannon and Weaver (Shannon & Weaver, 1949) introduced the notion that the information content of a message or event can be measured according to its impact on a recipient’s uncertainty. The message that “Bob is coming to the meeting” has no information value, for example, if its intended recipient knows this already or if the message is given to the recipient in a language she does not understand. In neither case does the message do anything to reduce the recipient’s “uncertainty” concerning who will be attending the meeting.

But making information exclusively about the reduction of uncertainty has come to be seen as overly restrictive (see Aftab, Cheung, Kim, Thakkar, & Yeddanapudi, 2001; Capurro. R & Hjørland, 2003; Cornelius, 2002). An exchange of information has a sender as well as a recipient, for example, and the exchange is not always collaborative. The sender may intend to “clarify the situation” and so reduce the recipient’s uncertainty. But of course the sender may have many other intentions. The sender may want to impress or persuade. The sender may want to increase the recipient’s uncertainty (“have you considered these other possibilities...”). The sender may even want to confuse or deceive.

Expressions of Intention occur often in the definitions of information provided by participants in the study described by Zins. Intention provides us with one way to distinguish information from data. Information is “the intentional composition of data by a sender with the goal of modifying the knowledge state of an interpreter or receiver” (p 485). Information is “data arranged or interpreted ... to provide meaning.” (p. 486).

A thing can be information or informative from the standpoint of the sender and gibberish or a non-event from the standpoint of intended recipient. I click the "OK" button on a Web site with the intention of making a hotel reservation. As far as I'm concerned the choices I've made as summarized on the Web page are information. But there is no information on the recipient's side if the transmission doesn't arrive, arrives garbled or is overlooked. To take another example, depending upon our life philosophy or religious conviction, we may or may not see nature as an intentional agent in the transmission of information. Regardless, we express the intention to treat sensory data as information when we say things like "What is my body/this tree/the sky/etc. trying to tell me?"

Just as the context-dependent notions of intention, uncertainty and meaning can be used to distinguish information from data, information as "out there" can be distinguished from knowledge as "in here". Participants in the Zins report describe knowledge as "embodied in humans", "assimilated" (p. 480), "in the mind of the knower" (p. 481), "held in human brains" (p. 483), "the interiorized content of information" (p. 485), "internalized or understood information" (p. 486).

Information as external is also "information as thing" Buckland (1991). With reference to this slant on information, one participant in the Zins study referred to knowledge as "no thing" (p. 481). Blair (2002) explores the "thingness" of data, information and knowledge through their substitution for one another in sentences such as "Put the data on the desk" or "Get the data and fax it to New York" (p. 1020). "information" substitutes readily for "data. But "knowledge" does not.

We acquire information quickly; we acquire knowledge only gradually. We can, for example, quickly acquire a book of German grammar and a German-English dictionary. But we acquire the ability to speak German only over time. We might say "I had the book of German grammar last week but seem to have lost it". But we would not, unless as an aftermath of a serious stroke, say thing like "I knew how to speak German last week, but seem to have lost this ability". But just as knowledge is acquired gradually, we can also speak of its gradual loss. We might say, for example, "I knew how to speak German in college but seem to have lost this knowledge over the years..."

Knowledge is everywhere within us but nowhere in particular. Knowledge is distributed. Knowledge is internal. We have knowledge. But rats too acquire a kind of knowledge as they learn to complete a maze. As Lashley (1950) made apparent in a famous series of experiments, this knowledge is not a thing that can be excised from the hapless rat through surgery. Performance on the maze degrades only gradually as a function the amount of brain tissue removed. The knowledge is apparently distributed throughout the cortex of an animal.

Larger assemblies of organisms, organizations of people and whole societies can also be seen to embody various kinds of knowledge. In his careful study of navigational activities on a carrier ship, for example, Hutchins (1994) described an organic process in which different abilities and responsibilities were distributed among the crew in a redundant fashion. This overlap in responsibilities and training procedures gave the ship as a whole an ability to repair and recover from losses in individual personnel.

Knowledge is clearly a good thing and worthy of our efforts to acquire and transfer. But knowledge is not a thing to be managed directly. Knowledge is managed only indirectly through information. As one

participant writes “Knowledge is not transferable, but through information we can communicate about it” (p. 486). Another participant writes “represented knowledge is information” (p. 481).

Consider the example of a manager who wishes to instill in her staff the knowledge of a new procedure of cost accounting. Her objective is that her staff follow this new procedure. She might wish there were a simple “neural plug-in” that could be applied to each member of her staff to accomplish the desired change. But this is not possible. Instead, the manager must use various forms of information. She communicates the new procedure in a meeting. She reinforces this procedure through email reminders and through diagrams posted around the office. She might even place sticky notes on the sides of display screens that her staff use.

Speeches in meetings, email messages, paper notes that stick -- the manager uses these and other forms of information as part of her intention to communicate new procedures and to effect a change that is eventually internalized in her staff.

She’ll judge her efforts a success when staff observe changes of procedure as a matter of course. Knowledge is as O’Dell et al. say “information in action” (1998, p. 5). Similarly, we might say that information is “data in motion” – data communicated, data sent or received with intention.

Alas, notwithstanding the manager’s intentions as she sends her directives, to some of her staff, these may be better described as data – ignored or not understood and certainly having no impact on their behavior or ways of thinking.

Will a message have a desired impact on its intended recipients? Obviously, the answer depends upon the content of a message. Some changes in office procedure are much easier to communicate and instill than others. But messages of roughly the same content can have very different impact depending upon attributes of their packaging and delivery.

Elsewhere, I define two terms that are useful in this chapter’s discussion:

*An **information item** is a packaging of information as a thing. Examples of information items include: 1. paper documents, 2. electronic documents, digital photographs, digital music, digital film and other files, 3. email messages, 4. web pages or 5. references (e.g., shortcuts, aliases) to any of the above. Items encapsulate information in a persistent form that can be created, modified, stored, retrieved, given a name, tags and other properties, moved, copied, distributed, deleted and otherwise manipulated. An information item has an associated **information form** which is determined by the tools and applications that support these operations. Common forms of information include paper documents, e-documents and other files, email messages and web bookmarks. (Jones, 2007, p. 37).*

The office manager uses at least three forms of information to communicate a change in office procedure: 1. The spoken words of a meeting. 2. An email announcement. 3. Sticky notes. The second and third are information items. The first is not (though its digital recording would be).

The ways in which an item is manipulated will vary depending upon its form and the tools available for this form. The tools used for interaction with paper-based information items include, for example, paper clips, staplers, filing cabinets and the flat surfaces of a desktop. In interactions with digital information items, we depend upon the support of various computer-based tools and applications such as email

applications, file managers, web browsers, etc. The ways we delete a paper document differ from the ways we delete an electronic document (e.g., tossing in the trash or shredding vs. using “Cut” or “Delete”) but some notion of deleting applies to each (a similarity the Macintosh reinforces through its metaphorical “trash can”).

The information item establishes a manageable level of abstraction for discussions of information and knowledge management. There are, for example, many essential similarities in the way people interact with information items, regardless of their form. Whether people are looking at a new email message in their inbox, a newly discovered web site or the business card they have just been handed at a conference, many of the same basic decisions must be made: “Is this relevant (to me)? To what does it relate? Do I need to act now or can I wait? If I wait, can I get back to this item later? Where should I put it? Will I remember to look?”

But also a person’s interactions with information vary greatly depending upon its form. Interactions with incoming email messages, for example, are often driven by the expectation of a timely response and perhaps also by the awareness that, when an email message scrolls out of view without some processing, it is apt to be quickly forgotten. A paper printout of the same message may be easier to read at an opportune moment (e.g., while stuck in traffic or standing in subway) but the printout is also more difficult to retrieve later if misplaced.

Some forms of information favor the sender; others the receiver (see Grudin, 1988). For example, we usually speak more quickly and easily than we write so that as senders of information, we may prefer the spoken to the written word. But as recipients of information, we generally read faster than we listen. Moreover, we can skim and skip through written information – something not easily done with an oral recording. Asymmetries between sender and recipient in the costs and benefits of different forms of information have implications for both information and knowledge management, which are explored further in the next section.

There is no management of knowledge except through a management of information.

“Management” comes from “manage” which derives from the Latin “*manus*” – hand.¹

The management practiced by our many of forbearers, those with no staff to order, was necessarily hands on. My grandfather was a dairy farmer. His management of his livestock and his crops was literally “hands on”. The same could be said for my grandmother as she managed the household. Or of the grocer who managed his store in town.

In our time, the expression “hands-on style of management” is not a redundancy nor even meant to be taken literally. Managers who are “hands-on” are more directly involved with their staff and with day-to-day details. Managers who literally manage their staff with the use of their hands risk run the serious risk of being sued for harassment.

¹ Sources used for definitions are the on-line services, Merriam-Webster OnLine (<http://www.merriam-webster.com/dictionary/>) and Wiktionary (<http://en.wiktionary.org/wiki>).

But we are still quite literally hands-on in many of our efforts to manage information. We compose an email message with finger presses to the keyboard and then we send the email with a click of the mouse button. Likewise, we use our hands on keyboard and mouse to work with electronic documents and with web pages. We make printouts for an even more direct interaction with our information. Paper forms of information endure (Sellen & Harper, 2002) in large measure for their hands-on affordances. Paper and the means to write on paper with pencil or pen are nearly always at hand. Paper can be folded, torn and thrown away. Writing, sketching or doodling on paper is easy and satisfying. There is a “feel” to paper that we may never achieve with digital forms of information.

Knowledge as “no thing” cannot be managed directly. If we think we have knowledge “at our fingertips” we are most likely touching information in some form instead. This is not to say that knowledge management is not possible. But we do so through its expression in information. There is no management of knowledge except through the management of information.

What are we doing when we manage information? What must we do to manage knowledge? These questions are each considered in turn.

What are we doing when we manage information?

Information as data – as bits – is a resource to be managed. The DAMA International Foundation in a pamphlet provided for download from their web site states that “The basic premise of Data Management (DRM) is that information and data is like any other business resource – and should be managed as such.” (DAMA International Foundation, 2005, p. 5). The pamphlet goes on to say that “the amount must be optimized. In other words, the company should always have enough--but also minimize excess and redundancy” and “resource should be shared and leveraged in as many ways as possible, in order to maximize its value while diminishing its overall costs”

These are sensible steps for a company to take with data, information or any other resource. Steps must be taken, for example, to insure that information is properly maintained. Information should be securely stored. Access to information should be controlled. Its use should be monitored. For information or data, viewed as a resource, considerations apply that aren’t that different from those that might apply to money or laptops or employee time.

But for information as “data in motion” additional considerations arise. Information can be copied and communicated. Information is sent and received with purpose or intention mind. Is information getting to the right people? Is it having a desired effect? Depending upon context, depending upon the recipient, the same information may save valuable time and money or be a waste of it.

One of the neater definitions of management² is “the judicious use of means to accomplish an end”. Mary Parker Follett, writing at the turn of the last century defined management (of people) as “the art of getting things done through people”. Substitute “information” for people and we have a nice definition for information management – the art of getting things done through information.

² Found in both Merriam-Webster OnLine (<http://www.merriam-webster.com/dictionary/>) and Wiktionary (<http://en.wiktionary.org/wiki>).

An ideal in information management is to have “have the right information (in the right place, in the right form, enough, not too much, etc.) to meet our current need” (Jones, 2007, p. 7). We come closer to this ideal to the extent that we’re able to create and maintain a mapping between information and need.

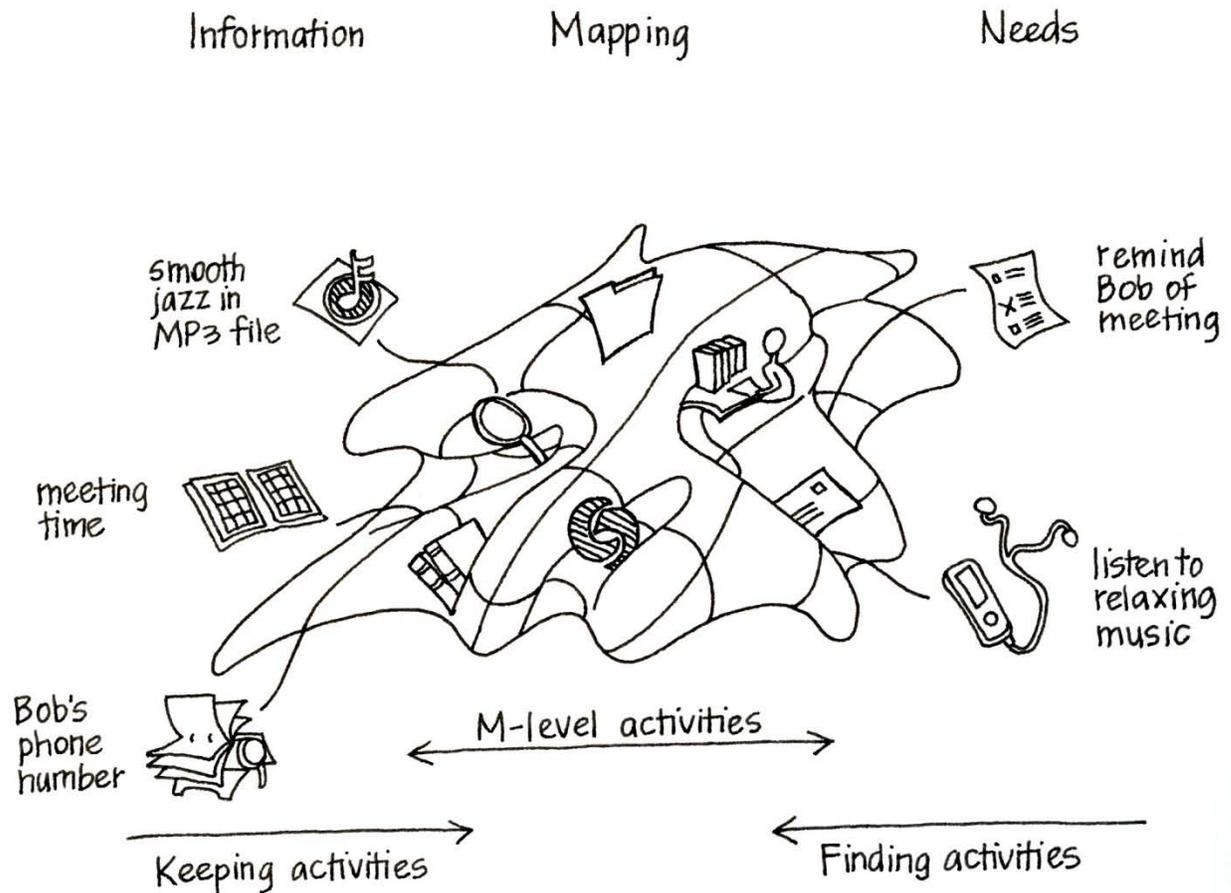


Figure 1. Information management activities viewed as an effort to establish, use and maintain a mapping between needs and information³

A simple, stylized mapping between information and need is depicted in Figure 1. Only small portions of the mapping have an observable external representation. In a company or as individuals, for example, we maintain folder structure or a tagging scheme which is visible in our filing systems, digital and paper-based. However, much of a mapping has only hypothesized existence in the memories of individuals and perhaps also in the policies, procedures and daily workflows of an organization. Large portions of the mapping are potential and not realized in any form, external or internal. A sort function or a search facility, for example, has the potential to guide from a need to desired information.

³ Figure 1 is an illustration done by Elizabeth Boling and is a variation of a figure that first appeared in Jones (2007).

With respect to the mapping, we have two basic kinds of information management activity corresponding to the two directions in which the mapping can be traversed: Keeping activities attempt to take us from information encountered to anticipated need. Finding activities attempt to go in the other direction – from need to information.

Finding: From need to information. In their efforts to meet a need, people seek. People search, sort and browse. People scan through a results list or the listing of a folder's contents in an effort to recognize information items that relate to a need. These activities are all examples of finding activities. Finding is broadly defined to include both acts of new finding where there is no previous memory of having the needed information, and to include acts of re-finding. More broadly still, finding includes efforts to create the needed information as in "finding the right words" or "finding the right ideas."

Keeping: From information to need. Many events of daily life are roughly the converse of finding events. Instead of having a need for which we seek information, we have information in hand and must determine what, if anything, we need to do with this information. In organizations and as individuals we encounter and generate large amounts of information. Decisions and actions are much the same no matter the information or its source. Is the information at all relevant, or potentially useful? Do we have an anticipated need for this information? What are the costs of not having this information? Some information – tax-relevant information for past years, for example -- must be kept even though the likelihood that a need for this information will arise is very small since the costs of not having this information, should the need arise, are very high (Jones, 2004).

Finding and keeping activities traverse the mapping in complementary directions. Four kinds of information management activity focus on the mapping itself. Elsewhere, I refer to these collectively referred to as **meta-level activities** or, simply, "m-level" activities (Jones, 2007):

Maintaining and organizing. How to ... organize information for repeated use? ... safeguard this information against loss? ... insure that information is current and correct? .. update formats to keep pace with changes in standards and in supporting tools?.. insure that old information is deleted, archived or otherwise moved out the way? What about versions? What about duplicates and near-duplicates? These are all questions of maintenance and organization.

Managing privacy and the flow of information. Information management aims to insure that the right people have the right information at the right time. But steps must also be taken to insure that other people – the wrong people – don't also have access to this information. And how to insure that the right people aren't distracted or overwhelmed the information they receive?

Measuring and evaluating. Choices are made in support of all the activities described so far. Schemes of organization are selected; strategies, policies and procedures are adopted; supporting tools are put in place. We then need to ask, periodically or continuously, "is it (the resulting mapping between information and need) working? Can it work even better? If so, what should change?" These questions depend both upon the measurements we're able to make and also on the evaluations we must make in cases where measurements (and the underlying objectives these measurements reflect) are in competition with one another.

Making sense of our information. Efforts to make sense are the most “meta” of meta-level activities. “Does it make sense?” The question can be applied to choices made in each of the other meta-level activities. The question has broad application and reaches to deeper levels of understanding concerning ultimate goals and tradeoffs. We might hear ourselves saying something like “I understand what you want to do but it doesn’t make sense”. Choices that make sense with one need in mind, may not make sense when other needs are also considered. Does the mapping make sense? Our information is now totally secure against unauthorized access but we can’t easily access the information either. Does this make sense? We make sense of information. We use our senses. We also “make” and manipulate. Information is a thing to be piled and sorted, arranged and re-arranged. Information is a thing to be touched. Information is in the mapping. Information is also how we represent the needs of a mapping (including goals and constraints). Information, perhaps in the form of graphs, is how we represent a hierarchy of need. Information is how we represent the synergies and conflicts between needs. Information is how we represent the mapping itself. It’s all information.

<forms of information> The importance of manipulation beyond visualization. Hands on. Example of Mendeleev. Knowledge through information. A point we return to as we consider what we must do to manage knowledge.

What must we do to manage knowledge?

To make a variation an old joke, ask any three people involved in “knowledge management” for a definition of same and you’ll likely get three different definitions. Wait a few more minutes and you’ll get three more.

In his blog post, “43 knowledge management definitions - and counting...”⁴, Ray Sims documents a diversity of definitions for knowledge management. Many of the definitions seem to have little in common with each other save for the repeated use of the word “knowledge”.

One of the better, more forthright, of the definitions comes from the CIO Magazine Tutorial⁵: “Unfortunately, there’s no universal definition of knowledge management (KM), just as there’s no agreement as to what constitutes knowledge in the first place. For this reason, it’s best to think of KM in the broadest context. Succinctly put, KM is the process through which organizations generate value from their intellectual and knowledge-based assets. Most often, generating value from such assets involves codifying what employees, partners and customers know, and sharing that information among employees, departments and even with other companies in an effort to devise best practices.”

The definition notes that “generating value” (from knowledge-based assets) involves information – the “codifying” of what people know and “sharing that information”. We can consider KM to require two essential transformations: From knowledge to information and then, to complete the transfer of knowledge, from information back to knowledge. The first transformation is often referred to as

⁴ <http://blog.simslearningconnections.com/?p=279>.

⁵ http://www.cio.com/article/40343/Knowledge_Management_Definition_and_Solutions, as viewed on January 31, 2009.

knowledge elicitation. We need a name for the second transformation as well. Call it *knowledge instillation*.

Knowledge elicitation⁶. Each of us knows a lot about matters big and small. We know, for example, how to spot and move away from erratic, potentially dangerous people on a street or subway platform. We may know (not I) how to use the buttons on a video game controller. Some of this knowledge is relatively easy to express. We know to stay clear of people who are shouting and screaming. But the more knowledge is integrated into our beliefs, our judgments and our actions, the less easy it is for us to give expression to this knowledge. Polanyi (1967) makes the distinction between *explicit knowledge* – knowledge readily expressed – and *tacit knowledge* -- knowledge not easily expressed. Polanyi offers, as an aphorism, that “we know more than we can tell”.

We can never tell all of what we know but methods of knowledge elicitation can help us to tell *more* of what we know. A review of all the various techniques of or with potential application to knowledge elicitation is beyond the scope of this paper. Techniques involve the use of repertory grids (Kelly, 1955), concept maps (Novak, 1998), affinity diagramming (Bondarenko & Janssen, 2005) , interviews – free-form or structured and observations (e.g., as an expert works through a selection of problems or cases) (Hoffman, 1989) . The person whose knowledge is being targeted may be asked to think aloud and a transcription of the recording of this think-aloud may later be subjected to a protocol analysis (Newell & Simon, 1972).

A point to make is that these methods are as much, if not more, about information as about knowledge. Each method involves several forms of information. Included, to be sure, are eponymous forms of information such as concept maps, affinity diagrams and repertory grids. Information in other forms is used to set the stage for a session with the expert . And the results of this session are recorded using other forms. In sessions with an expert underwriter in which I participated, for example, the underwriter worked through, one by one, a paper stack of applications for life insurance, thinking aloud

⁶ The term *knowledge elicitation* is often used interchangeably with but is to be preferred to the terms “knowledge acquisition” or “knowledge capture”. There is nothing wrong with “capture” as commonly used – as in “I want to capture these good ideas on paper” or “I want to capture this moment in a photograph”. It seems reasonable then to talk about capturing knowledge – as long as we understand that what is being captured is at best a pale reflection of the knowledge we actually have. The term “knowledge acquisition” is more problematic since it implies that knowledge has actually been transferred to, “acquired by” an someone – if not the targeted recipients then at least an intermediary (e.g., the person interviewing the expert). Nothing of the sort actually happens.

<These terms were used frequently in the 1980's in connection with efforts to build expert systems. Attempts were made to “acquire” or “capture” the knowledge of human experts for use in computer-based expert systems. However, these terms were not apt then and are even less apt now when knowledge management is more about attempts to facilitate the exchange of knowledge among people. Knowledge was never captured. Knowledge could only be said to have been acquired by an expert system after a time-consuming process of iterative tinkering of rules and representations. Whatever eventually found programmatic expression in the expert system bore only a passing resemblance to the forms of information (transcripts, rules inferred, diagrams, etc.) initially used to represent the results of interviews with the expert.

as he did so. His utterances were recorded and later transcribed. Paper-based applications, cassette recordings (this was in the 80's) and electronic transcription were each used in knowledge elicitation.

< Informational perspective is quite useful. Different semantics for different forms of information. Consider something as ordinary as a table. Good for expressing certain kinds of knowledge, not so good for expressing other kinds of knowledge. Example: Mendeleev. Calendars? < Rows mean one thing, columns another, their intersection a third. (as cells). Or consider the hierarchy as admirably suited to representation of problems. Cite Furnas. Hierarchy comes. Decomposition. Chunking. Forms of information with different affordances, different semantics support articulation of different kinds of knowledge?

Knowledge instillation. "Instillation" comes from "instill" as in "to cause to become part of someone's nature". Instillation neatly contrasts with "installation". Much as we might like to, we can't simply "install" a new body of knowledge in our brains or in an organization as we might install a new software program on our computers. Knowledge elicitation is only step one. Knowledge instillation is often the more difficult step in the transfer of knowledge. Popular books on knowledge management write of the barriers to transfer and change (e.g., Argyris, 1994). We read of the importance of creating a culture to promote knowledge transfer (e.g., O'Dell, Grayson & Essaiades, 1998) and of creating communities for the sharing of knowledge (e.g., Snyder & McDermott, 2002).

Challenges remain even when recipients are willing. Of potential relevance is wealth of education research on methods of teaching and learning (see, for example, Bransford, Brown, & Cocking, 2000). Of direct relevance, for example, is an ongoing debate concerning the extent to which – putting it plainly – people can be taught or need to learn for themselves (see, for example, Duffy, Lowyck, & Jonassen, 1993; Schwartz & Bransford, 1998).

Person-to-person contact remains one of the most effective ways to transfer knowledge. In educational contexts, for example, students working with individual human tutors test at levels of performance as much as two standard deviations higher than students in a conventional classroom (Bloom, 1984). Identifying expertise and locating experts is an area of research in its own right (e.g., McDonald and Ackerman, 2000). Now the Web provides a basis for a transfer of knowledge on a variety of topics ranging from home repair to cancer treatment⁷.

We can also recognize that instances KE and KI are commonplace and by no means limited to companies and classrooms. If someone asks you for directions or if you try to teach someone skill that you have and they don't (e.g., driving a car or driving a golf ball), you are doing KE. You may imagine the route or the way you drive in your "mind's eye". Or you may actually do the thing you mean to tell or teach. You may go to the destination or you may take the golf swing – observing your actions as you do so. In these examples, your objective is to render your skill, your knowledge, into forms of information (spoken instructions, hand gestures, reenactments) that can be communicated to someone else. But acts of KE are only a step one. Step two is for the other person to really understand, to "get it", and not just to nod

⁷ See, for example, <http://www.cancercompass.com/message-board.htm>.

as if he or she does. The ultimate proof is in the action but by then the costs of failure may be too high. Managers and parents alike often apply techniques to test for transfer such as having the intended recipient repeat the instructions or testing for choice points (“what will you do if..”).

< again form matters. Measurements and models in organization. New rules delivered in simple ways . The power of paper. The power of place. > proliferation of new forms of information – with different tools, different expectations – blogs, wikis. IM. Some enable a more story-telling approach – more orality. <reference story-telling approach in organizations> These capture knowledge. But not through head-long assault.

PKM is a useful subset of PIM.

We’re almost ready to address the questions posed at the outset of this chapter: What should PIM and PKM each be about and how should the two fields of study relate? But first, one more basic question. The previous section explored essential activities of information management and knowledge management. What does it mean to add “personal” to these terms? The question is considered first for PIM and then for PKM.

Six senses of personal information

How is information personal? Think of the possible connections between “information” and “me”. As summarized in Table 1⁸, information can be owned by me; about me; directed towards me; sent or published by me; experienced by me or, “relevant to” me. Each kind of personal information is briefly described below.

	Relation to “me”	Examples	Issues
1	Controlled by, owned by me	Email messages in our email accounts; files on our computer’s hard drive.	Security against break-ins or theft, backups, virus protection, etc.
2	About me	Credit history, medical, web browsing, library books checked out.	Who sees what when (under which circumstances)? How is information corrected or updated? Does it ever go away?
3	Directed towards me	Phone calls, drop-ins, TV ads, web ads, pop-ups.	Protection of me and my money, energy, attention and time.
4	Sent (posted, provided) by me	Email, personal web sites, published reports and articles.	Who sees what when? Did the message get through?
5	(Already) experienced by	Web pages that remain on the Web. Books that remain in a library. TV and radio programs	How to get back to information again later?

⁸ Adopted from Jones (2007).

	me	that remain somewhere in “broadcast ether”.	
6	Relevant (useful) to me	Somewhere “out there” is the perfect vacation, house, job, life-long mate. If only I could find the right information!	If only I knew (had some idea of) what I don’t know. How to filter out or otherwise avoid information we don’t wish to see? (How to do likewise for our children?)

Table 1. The senses in which information can be personal.

1. **Controlled by (owned by) me.** The information a person keeps, directly or indirectly (e.g., via software applications), for personal use is personal information. Included are email messages in an email account, files on the hard drive of a personal computer and also the papers kept on surfaces and inside conventional filing cabinets.⁹
2. **About me.** Information about a person but available to and possibly under the control of others is a second sense of personal information. Personal information in this category includes the information about a person kept by doctors and health organizations, for example, or the information kept by tax agencies and credit bureaus.
3. **Directed towards me.** Included in this category is the email that arrives in the inbox and also the pop-up notifications that this new email has arrived. Alerts raised by a person’s computer, the “push” of advertisements on a visited web page or the television or the radio, and the ringing telephone are all examples of information directed towards a person. The information itself may or may not be personally relevant. But the sender’s intention is personal and so to is the potential impact of the information on the person. information directed to a person can distract the person from a current task, consume a person’s attention and convince the person to spend time, spend money, change an opinion or take an action. We may be inclined to think of this incoming information as a nuisance, but sometimes this information serves the recipient well -- a fire alarm in the case of a burning building, for example, can be a lifesaver.
4. **Sent (posted, provided) by me.** Information sent by the person (or posted, published) is a fourth kind of personal information. This information may or may not contain information about the person. But the person as sender is personally invested in seeing that the information gets to its intended recipients. And perhaps the person is also invested in efforts to keep the information away from other people. For example, we may try to control, albeit imperfectly, who first sees the information in an email message we send. We may try to do this through choice of distribution lists and by including notices on the email messages such as “Confidential, please do not distribute”.
5. **Experienced by me.** Information experienced by a person is also personal information. Some of this information is under the person’s control and so also personal in the first sense of personal. Other information is not under the person’s control: The book a person browses (but puts back) in a

⁹ Note that even though information is, at least nominally, under the person’s control, the rights of ownership for portions of this information are sometimes in dispute. In the context of a person’s work inside a company or in collaboration with others, for example, it is often unclear who owns what information.

traditional library, for example, or the pages a person views on the Web. This fifth sense of personal information has special relevance to the first of two PKM questions: What do I know (already)?

6. **Relevant (useful) to me.** A final sense in which information can be personal is determined by whether this information relevant or useful to the person. Out there, somewhere, is an article that is perfect for a report we're writing or an advertisement for a vacation package that perfectly fits our needs. With respect to this expanded "sixth sense" of personal, we depend upon filters both to filter in the information we'd like to see and to filter out the information we do not want to see.

These broad categories have value not for what they exclude – in their union, they exclude very little.

Rather, categories each in their turn provide an important focal point for a discussion of PIM..

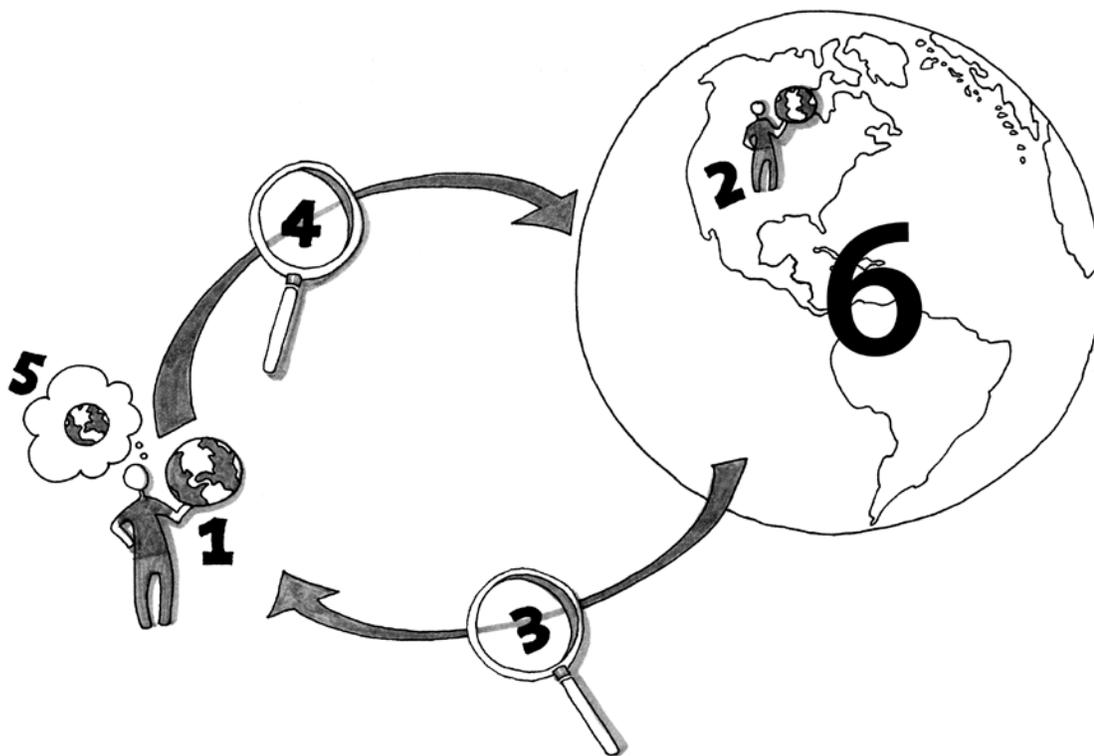


Figure 2. Six senses of personal information combine to make a personal space of information (PSI).¹⁰

When all is added together, each of us has a unique personal space of information, or PSI, as depicted in Figure 1. We inhabit this space as surely as we inhabit a physical space. Our informational space affects the way we view and interact with the world(s) we inhabit. Our space of information also affects the way we are seen, categorized, and treated by others.

Knowing what I know; knowing what I need to know

What about PKM? I described the transfer of knowledge as inevitably involving information in an intermediate stage. There is no such thing as a mind meld. The transfer is then in two parts with a different kind of knowledge management activity for each part:

¹⁰ Illustration by Elizabeth Boling.

1. From knowledge to information via activities of knowledge elicitation.
2. From information to knowledge via activities of knowledge instillation.

How do these activities become personal? It is not enough for these activities to be focused on an individual person. Knowledge management activities within organizations have long focused on individuals thought to have expertise that the organization as a whole could benefit from if only the knowledge could be transferred.

For activities of knowledge management to be personal, it would seem that these also need to be done by or at least initiated by the person and with the expectation that the person stands to benefit from the completion of these activities.

The self-interest in managing each of the six senses of personal information is evident as we go through the list from the first to the sixth sense of personal information. If information owned by us is not properly managed and we lose it (e.g., in a disk crash) we could lose days, possibly years of work. If information about us (credit card numbers, for example) falls into the wrong hands, others could use this information to take money from us. And so on. For each sense, we can tell a story either of bad things that might happen if the information is poorly managed or the good things that might happen if the information is managed better.

Likewise, for each of the two kinds of knowledge management activity, we can ask a question that makes personal interest apparent:

1. **What do I know already?** The question has many aspects. What skills do I have? What can I “do”? The question arises any time we look for a new job or a promotion. We don’t want to over-sell our abilities but too often we do the opposite. We undersell our abilities not (not only) from a sense of modesty but also because much of our knowledge is deeply ingrained. To use the distinction discussed in the previous section, our knowledge is tacit and so not easily expressed for assessment.
2. **What do I need to know? (What should I be learning?)** Again, using a work context, we look for the skills and know-how we should acquire either to get a better job or simply to keep the job we have. Where should we invest our time and effort? Answers depend partly on answers to the first question and partly on an assessment of the world out there. What are companies looking for? What jobs pay the best?

For purposes of illustration, these questions have been set against a backdrop of employment. But the scope of each question readily expands. What do you know that might help you in social situations? Or situations with both a social and business aspect? How many people are learning golf only for the pleasure of the play?

We don’t need to stop at this level. What about deeply held beliefs and ways of viewing the world? How do we assess these to understand their impact in our daily life? How do we change those that keep us from being happy? A range of insight or “talking” therapies can be seen as a kind of PKM.

<knowledge through information. Incidental. Incremental – rules established over time, stepwise knowledge elicitation. Integrative? >

<forms of information for instillation. – the tape in the car, the paper taped to the door.>

Conclusion

what good is the PIM perspective? what good is the informational perspective? Consider information -- in many forms -- as means of representation and communication. what gets communicated. to what extent is the medium the message? Simulation. Full motion simulators. aren't these informational? What is information? direct vs. derived.

Examples:

1. The tv screen – gives box view of reality. We extrapolate.
2. The magician.
3. <information gives us useful focus. Look about everyday chances to elicit and instill knowledge: Driving in car, as we're walking along (capture), ok "capture" isn't so bad,

<Information is where the rubber hits the road. Where hand meets concepts in things to be seen, touched, changed.

<Information is also about communicating and other people. All about this. Strong social aspect. With great power>

<the importance of manipulation – as thing – not just visualization. Contrast of Planner with Outlook>

Even though the term "knowledge" tends to get excessive and indiscriminant use when the term "information" would do just as well, some useful distinctions between the terms can be drawn. One distinction essentially says that "knowledge" is what is in a person's head or perhaps also embedded in a tool or a system. Knowledge is implicit, difficult to see, difficult to articulate.

Knowledge acquisition/elicitation has been an important area of study in its own right receiving special prominence in the 1980's with all the (mostly unmet) expectations concerning the promise of expert systems. Experts know a great deal but eliciting this knowledge in a form of rules that could be used by an expert system is not easy. This area morphed into the knowledge management movement of the 90's with its focus on finding ways to capture, share and better leverage the knowledge embedded within corporations and other organizations (in key people, teams and processes).

By extension we could say that a key challenge of PKM would be to make explicit –to elicit -- the knowledge of a person. The "P" in PKM is not because focus is on the individual person –corporate knowledge management efforts often focus on the elicitation of knowledge in key people of a company, especially area experts and especially if they are about to retire. "P" would mean, rather, that a person perceives some personal benefit in elicitation of his/her hidden knowledge. Doing so could be revealing or even therapeutic. Also, not all knowledge is good knowledge. Some knowledge may be a tangle of old fears, prejudices, and assumptions that, though no longer valid, still drive a person's behavior in

maladaptive ways. As therapists would tell us, giving this knowledge expression is the first step towards releasing its hold on us.

But here's an important point: Knowledge elicited is usually written down in some form. Maybe as a list of "principles and rules that I use when I do ...". These may be represented in plain text, if-then rules, complicated diagrams, etc. Others may read and learn so that they acquire and internalize some reasonable facsimile of this knowledge. In this case we can say the knowledge has been transferred. But the vehicle of transfer is information. Knowledge written down is information -- to be managed like other information.

We're back to PIM.

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