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Pictorial metaphors for information

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Abstract

Purpose – Arts-informed, visual research was conducted to document the pictorial metaphors that appear among original drawings of information. The purpose of this paper is to report the diversity of these pictorial metaphors, delineate their formal qualities as drawings, and provide a fresh perspective on the concept of information.

Design/methodology/approach – The project utilized pre-existing iSquare drawings of information that were produced by iSchool graduate students during a draw-and-write activity. From a data set of 417 images, 125 of the strongest pictorial metaphors were identified and subjected to cognitive metaphor theory.

Findings – Overwhelmingly, the favored source domain for envisioning information was nature. The most common pictorial metaphors were: Earth, web, tree, light bulb, box, cloud, and fishing/mining, and each brings different qualities of information into focus. The drawings were often canonical versions of objects in the world, leading to arrays of pictorial metaphors marked by their similarity.

Research limitations/implications – Less than 30 percent of the data set qualified as pictorial metaphors, making them a minority strategy for representing information as an image. The process to identify and interpret pictorial metaphors was highly subjective. The arts-informed methodology generated tensions between artistic and social scientific paradigms.

Practical implications – The pictorial metaphors for information can enhance information science education and fortify professional identity among information professionals.

Originality/value – This is the first arts-informed, visual study of information that utilizes cognitive metaphor theory to explore the nature of information. It strengthens a sense of history, humanity, nature, and beauty in our understanding of information today, and contributes to metaphor research at large.

Keywords Information theory, Information, Metaphor analysis, iSquare, Visual research, Visualization of information

Paper type Research paper

1. Introduction

Metaphors are ubiquitous means by which people structure thought. They have an important function as mind settings, which influence our cognition of the self and the world (Moser, 2000). Building on a tradition of research into verbal metaphors, since the 1990s there has been growing interest in visual or pictorial metaphors. A number of studies have explored visual metaphors in diverse genres, such as advertising (Forceville, 1996), films (Carroll, 1996), and cartoons (Morris, 1993).

In the work at hand, arts-informed, visual research, and the draw-and-write technique were combined with metaphor analysis to provide a new perspective on the concept of information. The study is based upon an exercise in which graduate students express information as a drawing, and explores the pictorial metaphors that appeared in such drawings. The project contributes to the conceptions of information already in the literature; demonstrates a novel interdisciplinary methodology and research design; and has benefits for information science education and professional practice.

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Metaphors link two conceptual domains, the source domain and the target domain. By means of an expression taken from a concrete area (the source domain), something located in the target domain may be made more understandable. The target domain is abstract, unknown, and difficult to envisage, as far as its meaning is concerned (Lakoff, 1987, pp. 276-278). To fully understand abstract things, it helps to refer to concrete, physical, or tangible things. For example, in the metaphorical expression "Love is a journey," everyday knowledge about journeys (the source domain) is mapped onto knowledge about love (the target domain). By means of such correspondences, we may come to understand love through our knowledge of journeys. In this example, metaphor is a linguistic device, but the same correspondence strategy can be used in the visual realm.

More than 2,000 original drawings of information have been collected in the iSquare research program (www.iSquares.info). The majority of the images take the form of literal representations of information, namely depictions of documents, technology, and/or people (Hartel, 2014a). The authors of this paper noticed that alongside many literal renderings were pictorial metaphors, in which information was expressed as a tree, light bulb, or city, among other easily recognizable source domains. A literature review confirmed that the pictorial metaphors for information had yet to be systematically identified, documented, and explicated – which are the objectives of this study.

The paper proceeds as follows. Section 2 reviews relevant writings on metaphors, pictorial metaphors, and information visualization. Section 3 specifies the research questions, followed by the theoretical framework and research design in Section 4. Section 5 discusses the results: elaborations of common pictorial metaphors for information. Section 6 is a discussion with a summary and implications of the study; the paper ends with Section 7, a brief conclusion.

2. Metaphors and metaphor-related research

2.1 Conceptual metaphors

Since the 1980s, conceptual metaphor theory (CMT) has provided a predominant perspective on the study on metaphors. CMT was developed within the field of cognitive linguistics, and this theory became widely known with the publication of *Metaphors We Live By*, by George Lakoff and Mark Johnson, in 1980. One of the strengths of metaphors is that they create a stereoscopic vision that allows simultaneous viewing of an idea from two or more points of view. Metaphors can provide a new or alternative view of a given target domain by linking it with an unexpected source domain, or by mapping unexplored features from a familiar source domain to the target (Lakoff and Johnson, 1980, pp. 10-13).

There are a number of common source domains. The human body is an ideal source domain, since, for us, it is clearly delineated and (we believe) we know it well. Other source domains include, for example, animals, plants, buildings and construction, machines and tools, games and sport, money, cooking and food, heat and cold, light and darkness, forces, movement and direction (Kövecses, 2010, pp. 18-22). When this rich knowledge about elements is mapped onto target domains, we have cases of metaphorical entailment (Kövecses, 2010, p. 132). Each source concept has a metaphorical entailment potential; that is, it can potentially map extensive everyday knowledge onto the target domains that are abstract, diffuse, and lack clear delineation (Kövecses, 2010, pp. 23-29).

2.2 Multimodal and pictorial metaphors

The vast majority of studies inspired by CMT focus on verbal manifestations of metaphor. However, it can be argued from the viewpoint of CMT that there is no natural or exclusive verbal link between a source and target domain (El Refaie 2003, p. 76). As metaphor is not an exclusive attribute of language, it should also be capable of assuming non-verbal manifestations. Hence, any form of communication – verbal as well as non-verbal – can be seen as an instance of metaphor, if it is able to induce a metaphoric thought or concept. Forceville (2009, pp. 21-22) argued for a broader view by introducing the concept of multimodal metaphor. It was defined as a construct in which source and target features are represented by at least two different sign systems (one of which may be language) or modes of perception.

According to Forceville (2008), some multimodal metaphors can be described as pictorial metaphors in which the source and target domains are images. The pictorial nature of target and source means that they are apprehended differently from their verbal counterparts: pictures have a perceptual immediacy that is lacking in language. Pictorial representations have different, medium-determined ways of cueing the similarity between target and source than language has. Inasmuch as pictures are more easily recognized transnationally than (unfamiliar) languages, pictorial and multimodal metaphors allow for greater cross-cultural access than verbal ones. Finally, pictorial source domains may have a stronger emotional appeal than verbal ones. However, one of the main difficulties of pictorial metaphor analysis is that in pictures there is no equivalent to the verbal *is* or *is like* (Forceville, 2008). Thus, a picture strongly or weakly invites a viewer to construe a metaphor, rather than to say that a picture contains a metaphor.

2.3 Studies on pictorial metaphors and visualization of information

So far, there is a paucity of research into pictorial metaphors of information or information behavior. One of the rare examples is Savolainen's (2006) analysis of the construct of information use proposed by Dervin's Sense-Making Methodology (Dervin 1999; Dervin and Frenette, 2003). The source domain of the metaphor was examined by focussing on the graphical illustrations of sense-making metaphors such as gap-facing and gap-bridging. The findings indicate that the metaphor of gap-bridging is constitutive of the Sense-Making Methodology as a whole, and ultimately, all phenomena of sense-making can be reflected by drawing on this root metaphor.

More recently, Hartel (2013) made use of the ideas of metaphor analysis in a study focussing on the work of canonical information scientist Marcia J. Bates through the original metaphor of "castles and inverted castles." An intellectual biography and close reading was performed on a sample of eight major papers by Bates. The findings indicate that the metaphorical construct of castles – elaborately built seats of power that bridge borderlands – express many of the unique qualities of Bates's work. The construct of inverted castles – an invention of the author – reflects an additional utilitarian and pedagogical aspect of her thinking.

The ongoing iSquare research program (www.iSquares.info) employs an arts-informed (Cole and Knowles, 2008), visual approach and the draw-and-write technique (Pridmore and Bendelow, 1995). It addresses three issues, namely: the way people visualize the concept of information; the difference in those visual conceptions of information among various populations; and the relationship between the visual conceptions and the written definition of information. In a classroom setting, research

subjects are given a 4.25 by 4.25-inch piece of white art paper and a black pen, and asked to respond to the question "What is information?" in the form of a drawing and then to create a caption for the drawing on the reverse side. The ten-minute activity produces a compact piece of visual and textual data, coined an information square or iSquare for short.

After subjecting iSquares to compositional interpretation (Rose, 2007) and a framework of graphic representations by Engelhardt (2002), Hartel (2014a) reported that the participants rendered information as pictures of people, print artifacts, landscapes, and patterns; they also drew link diagrams, grouping diagrams, and symbols. A subsequent thematic analysis (Guest, 2012) determined that 43 percent of the iSquares displayed people engaged information behavior, which was conveyed visually as hands, the brain, a person thinking, an individual in a context, a twosome in information exchange and an information-rich social world (Hartel, 2014b).

3. Research questions

The above review of pictorial metaphors and Hartel's prior iSquare research into visual conceptions of information provide a foundation for the development of three research questions are as follows:

RQ1. What are the main pictorial metaphors used by iSchool students when expressing information as a drawing?

RQ2. What are the formal qualities of these depictions?

RQ3. What makes the resulting pictorial metaphors suitable for conceptualizing information?

This third question illuminates the metaphorical entailment, that is, the ways in which the potential of everyday knowledge possessed by the students is used to make the target domain, i.e. information, intelligible by means of drawing pictures of a concrete source domain (Kövecses, 2010, pp. 23-29). More specifically, in exploring entailments, attention will be focussed on how the image of the source domain makes the structural, social, technological, functional, or symbolic qualities of information more comprehensible and vivid.

4. Theoretical framework and research design

Arts-informed methodology (Cole and Knowles, 2008) combines the systematic and rigorous qualities of conventional qualitative methodologies with the artistic and imaginative features of the arts. The approach emerged from the field of education and is spreading to other disciplines. In arts-informed research, poetry, literary prose, playwriting, visual arts, dance, and music function as data gathering vehicles. The methodology and its adherents embrace a natural, responsive, intuitive, and reflexive sensibility throughout the research project. There is a pronounced commitment to an inquiry process and results that are accessible, engaging, and memorable to audiences including but beyond the academy.

There can be a delicate balance and at times a conflict between the hybrid epistemologies in arts-informed studies, since they combine features of the social sciences and humanities. For example, the work at hand adheres to the social science practice of sampling a population of human subjects. However, from an arts-informed stance, the boundary around the resulting data set may be porous, to allow the imagination of the researcher to be unrestricted in its conclusions. Data from a

legitimate neighboring source may complement the study if it supplies compelling insights and has communicative power; in such cases the aberration is acknowledged and appropriately justified. Further, data sets are not treated solely as expressions of the subjects' reality that are to be authentically reported, but are deemed visual artifacts open to interpreted by the investigator based upon their own perspective. Going forward, the methodological tensions that manifest in this arts-informed, visual study of pictorial metaphors for information are duly noted in order to increase awareness of the complexities of arts-informed inquiry, since it is relatively new to information studies.

This examination of pictorial metaphors for information utilized the iSquare corpus of 2,000 original drawings of information as a data source. Interested readers can see Hartel (2014a) for a review of the draw-and-write technique across the social sciences and in information science and for additional details about the iSquare data gathering protocol, which is also outlined at www.isquares.info/isquare-protocol.html.

As a first step, a sample of 417 iSquares from Canada, Croatia, England, and Finland were extracted from the larger corpus. The sample was convenient and purposive, since the populations that produced the drawings were geographically and culturally familiar to the researchers, who lived in Canada and Finland, respectively. The iSchool students (rather than graduate students from other disciplines) were considered an ideal community to probe for pictorial metaphors because they are required to reflect on the nature of information in their lives and society. The gender distribution across the data set were 60 percent female and 40 percent male, with a mean age of 26, though these demographics were not factored into the analysis or findings. The sample is profiled in Table I.

For this project and paper, analytical attention was placed on the drawing of information that appeared on the front side of the square, not the text statements captured on the reverse side, because the text statements often failed to illuminate the drawings and confounded the analysis process, as explained in Hartel (2014a, p. 1364).

4.1 Pictorial metaphor analysis

Our approach to pictorial metaphor analysis follows a study of the financial sector by Oberlechner *et al.* (2004), who reported how textual metaphors can contribute to a better understanding of the foreign exchange market and of its actors. The research team conducted 55 interviews about the foreign exchange market with senior foreign exchange experts. From the interview transcripts they isolated metaphorical

Country	iSchool	Instructor/data collectors	No.
Canada	Faculty of Information, University of Toronto	Jenna Hartel, Rebecca Noone, Karen Pollack	292
Croatia	Department of Information Sciences, University J.J. Strossmayer	Sanjica Faletar Tanackovic	45
England	Information School, University of Sheffield	Jenna Hartel, Melanie Benson	62
Finland	Information Studies, School of Business and Economics, Åbo Akademi University	Isto Huvila	18
Total			417

Table I.
Profile of the sample

Source: 417 drawings of information extracted from the larger iSquare corpus

statements about the market, resulting in a list of seven decontextualized metaphors. The seven statements were clustered and labeled according to shared metaphorical roots, namely the exchange market as: a bazaar, a machine, gambling, sports, war, a living being, and an ocean. The findings discussed what the metaphors implied about market dynamics. Though the precedent dealt with metaphor in verbal form, we adopted a similar systematic process for the identification, analysis, and interpretation of pictorial metaphors for information.

4.2 Elimination of non-pictorial metaphors

Since not all drawings of information in the iSquare data set are pictorial metaphors, an elimination process was necessary. Qualifying a metaphor, pictorial or otherwise, is highly subjective and we acknowledge the potential for variability in all interpretations. Naturally, we did not have access to what the students were thinking when they drew the pictures nor their familiarity with existing conceptions of information in the literature. Therefore, initially our engagement with the images was denotative, that is, concerned with the literal or commonsense meaning of what appeared on the iSquare. At this point in the study, the tension between artistic and social scientific approaches was acute, since the former endorsed an intuitive recognition of a pictorial metaphor, and the latter required clear criteria to be operationalized.

Both authors independently checked all the 417 iSquares for the potential presence of a pictorial metaphor, as manifest in a recognizable and unambiguous source domain. Each author classified the drawings into three categories: relevant, marginally relevant, and irrelevant drawings (which corresponded to strong vs weak pictorial metaphors). Next, the researchers compared the three data sets. Drawings rated as relevant by both authors were included in a combined sample, while drawings deemed as irrelevant by both authors were excluded. Drawings classified as marginally relevant were then negotiated by the research team in order to achieve consensus about whether they should be included in the sample or not. Of note, during the screening process, both researchers had identified many "marginally relevant" images, indicating that the process to identify pictorial metaphors was subjective and benefited from negotiated determinations.

The aforementioned process to reduce the data set to pictorial metaphors was informed by the idea of visual syntax. Metaphors in verbal form are marked by an "is" or "is like" syntax to relate the source and target domains. Though a syntax of the visual realm is contested, we employed a framework of graphic representations by Engelhardt (2002) that suggests the rudiments of a graphic syntax. What Engelhardt calls grouping diagrams, link diagrams, tables, and text were usually eliminated because their graphic syntax did not suggest an "is" or "is like" construction. Abstract patterns, ambiguous images, and blanks were also struck from the data set. Finally, we rejected any drawings that featured information artifacts (such as books or book collections), activities (for example, conversing face-to-face or reading) or technologies (for instance, computers or handheld devices), which were deemed literal, not metaphorical, conceptualizations. The types of drawings determined not to be pictorial metaphors and thereby removed from the data set are shown in Figure 1.

After eliminating non-pictorial metaphors, the original data set of 417 was reduced by 292 to 125. Thereby, less than 30 percent of the data set qualified as pictorial metaphors, making them a minority strategy for representing information as an image.

4.3 Identification of common pictorial metaphors for information

The remaining 125 iSquares were analyzed inductively by the researchers to identify recurring pictorial metaphors. Those that appeared at least twice were named with a succinct term for the source domain. The fourteen most common pictorial metaphors and their frequencies are shown in Figure 2.

Due to space limitations in this paper we decided to limit further analysis to a smaller set of pictorial metaphors. From the fourteen shown in Figure 2, seven were chosen based upon their prevalence and diversity. To achieve diversity, for example, we included information as Earth (but not mountains); information as tree (but not seedling); and information as light bulb (but not sun) since each of these dyads have significant similarities. The pictorial metaphors selected were information as: Earth, web, tree, light bulb, box, cloud, and fishing/mining. One additional pictorial metaphor of information as eye did not appear in this data set but was widespread in the larger iSquares corpus and was treated to further analysis, as well – a liberty sanctioned by the arts-informed philosophy.

Next, each set of pictorial metaphors was examined carefully for its formal qualities by asking "What is it? What is happening? How is it drawn?" We then sought to articulate the relationship between the source domain and the target domain of information. To that end, attention was sharpened by the following questions.

Link diagrams	Grouping diagrams	Text	Abstract patterns	Ambiguous images	Blanks	Information artifacts, activities, or technologies
						
In a link diagram (Engelhardt, 2002, p. 140) the syntactic structure involves linking through the use of lines or arrows. These drawings more closely resembled stories or processes than pictorial metaphors	In a grouping diagram (Engelhardt, 2002, p. 141) the syntactic structure serves to express the categorization of a set of elements. These drawings were akin to lists or classification schemes than pictorial metaphors	Text is a kind of graphic representation, too, and many iSquares feature text (Hartel, 2014a, p. 1362). Given our interest in pictures, we placed these iSquares outside the study	Some squares were covered in abstract patterns (Hartel, 2014a, p. 1359). Given the difficulty of interpreting these images, we eliminated them from the study	When both researchers deemed the image to have an ambiguous meaning, it was removed from the data set	Occasionally, participants responded to the text prompts on the back side of the paper, but did not produce a drawing (Hartel, 2014a, p. 1363); these "blanks" were eliminated from consideration	There were many pictures of information artifacts, activities, and technologies. Such literal representations do not function as pictorial metaphors and were placed outside the study

Figure 1.
Types of drawings deemed not pictorial metaphors and removed from the data set

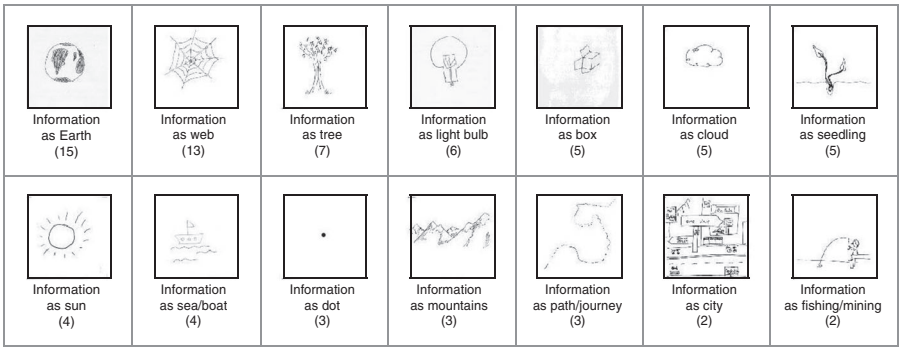


Figure 2.
Total 14 common pictorial metaphors for information and counts of their frequencies

"What does the drawing suggest about information?" or "How is information like this?" At this point in the analysis process, our emphasis shifted from a denotative to a more connotative reading that tapped cultural associations of the image and its positive or negative emotional tenor. Our knowledge of the source domains was based upon our innate cultural and visual literacies, as well as general encyclopedias and visual dictionaries (e.g. Becker, 2000; O'Connell and Airey, 2011; Tressider, 2004). An understanding of the target domain of information was shaped by writings about information in the scholarly literature (e.g. Bates, 2010; Buckland, 1991, Case, 2012 Chapter 3). On this basis, the first author conducted a preliminary analysis of the selected pictorial metaphors. The second author commented on the findings by suggesting additional or alternative viewpoints to the interpretation. Again, different viewpoints were negotiated to reach consensus about the characterizations of the source domains depicted in the drawings.

The results from the analysis process appear below by prevalence and in visual arrays of six. If fewer than six examples were present in the original data set, we inserted analogs taken from the larger corpus of iSquares, a practice that is justifiable within the arts-informed paradigm, since the abundance of images makes the ideas significantly more accessible to readers.

5. Results

5.1 Information as the Earth

The Earth was the most commonly rendered pictorial metaphor for information. In these visions, our planet appears at the center of the iSquare as if sketched from the moon. While some of the Earths are uninhabited, others are populated with tiny, undifferentiated stick figures. Arrows, lines, and dots surround the Earths and suggest highly abstract and dynamic information and communication flows (Figure 3).

A pictorial metaphor of information as the Earth showcases the magnitude of information today. Here, information is deemed vast; it transcends states, nations, and continents. The lines and arrows that surround the Earth and animate the drawing capture the unprecedented ability of information to connect one hemisphere to another. The white space around each globe, the atmosphere, is a reminder that information moves invisibly through the air via wireless technology and communications satellites. Though the human beings are relatively small and nondescript, their presence nevertheless establishes information as a social phenomenon, since the Earth is foremost our home. In an upbeat manner, information as the Earth projects the universality to the information age and the global free-flow of ideas. Unfortunately, the grand scale of this visual metaphor obfuscates digital divides and information poverty, among other problems.

5.2 Information as a web

Representations of information as a web can be associated with the common term for the internet, "World Wide Web," coined by Tim Berners-Lee in 1989. These drawings

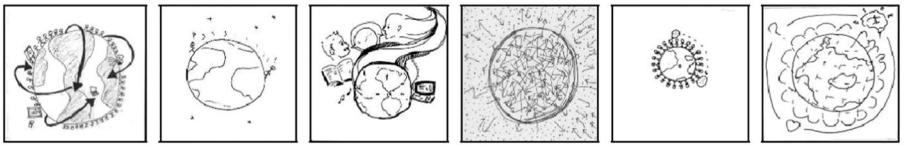


Figure 3.
Information as the Earth

take the recognizable shape of the orb weaving spider, with an epicenter, radials, and capture spiral; or they are the more tangled and asymmetrical cobweb built by other spider species. Many renderings include human figures, information artifacts, and symbols at junctures or within cells. Sometimes, movement is suggested by dashed lines or arrows along the threads (Figure 4).

The pictorial metaphor of information as a web brings attention to the structure of information. Here, information is cast with a Cartesian sensibility upon a plane made of intersecting points, lines, and cells. This pictorial metaphor posits information as distributed, parceled, and spacious rather than centralized, monolithic, and dense. The silk that forms a web is invisible and quite strong, qualities shared by information, too. The different styles of web further imply two possible architectures for information. The symmetrical orb web can be linked to faceted classification schemes, such as colon classification. The irregular cobweb resembles a more organic information structure, such as a tag cloud.

A positive association of the web metaphor is its relatively egalitarian layout that contrasts with the hierarchical tree metaphor, discussed next. A negative association is its almost abstract simplicity which erases the sometimes messy social and cultural context deemed increasingly important in information research. Another dark side of this pictorial metaphor is the web's function in nature as a sticky trap, a reality for internet addicts who feel ensnared online.

5.3 Information as a tree

Easy-to-draw and often invoked by iSchool students, a tree provides a rich and layered pictorial metaphor for information. Those in the data set were rendered in a fundamental form, that is, a singular upright trunk topped with a round, bushy canopy of leaves – like the majestic oak. In almost all cases the trees were shown in the full bloom of a seasonal life cycle; stood solitary (rather than in a forest); and lacked flowers, fruits, or animal inhabitants (Figure 5).

Among all the pictorial metaphors, trees bring the most symbolic and also wide-ranging meanings to information. One participant wrote "tree of knowledge" in the canopy and surely others were motivated by the same idea. In the Judeo-Christian tradition, the "tree of knowledge of good and evil" grew in the Garden of Eden; Adam and Eve ate its forbidden fruit and brought sin into the world. In Indo-European, Siberian, and native American religions, a colossal "world tree" links the heavens, terrestrial world and underworld together and serves as a means of communication between the realms.

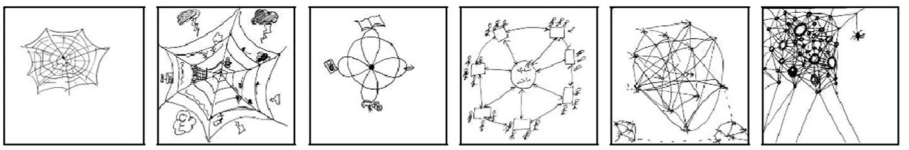


Figure 4.
Information as a web

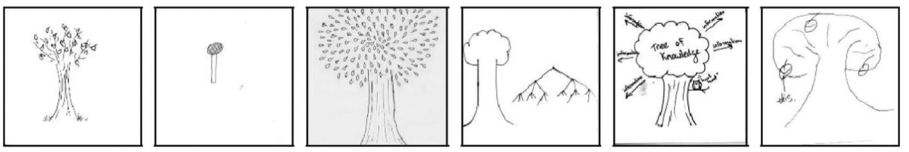


Figure 5.
Information as a tree

Two famous thinkers, Isaac Newton and the Buddha, purportedly generated big ideas while sitting under a tree. These enduring myths and visions of trees involve information in profound spiritual matters, the nature of reality, and the origins of humankind, depths not well-explored in information science (Kari and Hartel, 2007).

Like the aforementioned web, a visual metaphor of a tree focusses attention on information as a structure. The branches and roots of trees extend in a vertical, dendritic manner, dividing into ever smaller entities that inherit resemblance from their source. The form mirrors classification systems, such as the Dewey Decimal system, organizational charts, and family history diagrams. This pictorial metaphor suggests a rather traditional information environment of a neat and controlled hierarchy.

Picturing information as a tree assigns other qualities to information. The tree is a living organism that grows and changes with the seasons, thereby information is cast as organic and evolving. The majority of the Earth's terrestrial biomass is represented by trees, hence information is envisioned as a most ubiquitous and voluminous commodity. Trees are both soaring and grounded, positive states that can be attributed to information, as well.

5.4 Information as a light bulb

Another frequently appearing pictorial metaphor for information is a light bulb. Many students drew the quintessential incandescent light bulb, with its round glass orb, narrow grooved neck, and delicate internal filament. Though all lack an apparent power source, most of the light bulbs are turned on with rays of light shining outward (Figure 6).

A pictorial metaphor of information as a light bulb assigns a functional role to information. Just as a light bulb illuminates the dark, information is seen to illuminate an ignorant mind or murky situation. Flipping the switch of a light bulb also initiates a flow of energy, another empowering and positive impact of information. Relying upon the same trope, a classic statement on information use environments says that information use leads to "enlightenment" (Taylor, 1991, p. 231).

In cartoons, a light bulb is an "upfix" (Cohn, 2013) that appears over the head of a character with an idea, a reference to Thomas Edison's breakthrough refinement of the device. Hence, this pictorial metaphor implicates information in creativity and discovery, especially in science and engineering. The domain analytic perspective (Hjørland and Albrechtsen, 1995) holds that information is socially constructed within scholarly discourse communities. It could be that pictorial metaphors for information are shaped by academic cultures, too. In the domain analytic view, then, a light bulb may capture the flash-bulb ("eureka!") nature of information in the sciences but not the graceful dawning of insight in the humanities.

Overall, the light bulb metaphor is very positive since light helps to see things more clearly. It hints at playful qualities of information, too. A whole genre of light bulb jokes exist that tease people about their profession or hobby, such as, "How many librarians does it take to screw in a light bulb?" The answer: 645.5 – Dewey

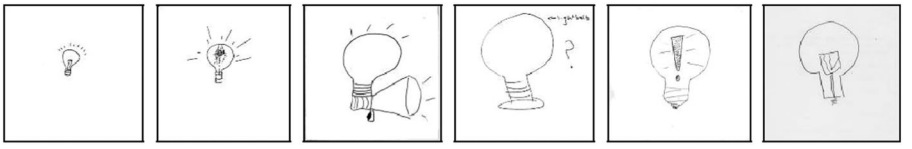


Figure 6.
Information as a light bulb

Decimal Classification 645.5: household furnishings – lighting fixtures. However, having too much light can be blinding. Information as a sun, a pictorial metaphor we chose not to discuss because of its similarity to a light bulb, is a more powerful and potentially overwhelming light source that implies the discomfort of information overload.

5.5 Information as a box

Some students pictured information as a box. Typically, the box is rendered as a singular cube with three dimensions. In many instances it is open to reveal an inner space, whereas others remain closed and opaque. A question mark appears on two boxes, suggesting answers or something unknown inside (Figure 7).

A box is an ambiguous pictorial metaphor, since information may be the walls of the box, its contents, or both. Uncertainty aside, this conception is a reminder of Brenda Dervin's (1983) "container" critique of information behavior research. According to Dervin, in some research programs, information is perceived as a brick put into a human bucket, and she argued in favor of more holistic and qualitative research designs (Therefore, she would likely find information as a box to be a problematical vision). In the fields of science, computing, and engineering, these drawings may invoke what is commonly referred to as a "black box" system that has hidden internal workings, casting information as something concealed beyond view. Alternatively, the box may belong to a famously inquisitive woman, Pandora. Though warned not to do so, Pandora opened a box and unleashed ills upon the world; according to this myth, information makes us curious and can cause serious trouble. Though wide-ranging, these various conceptions cast information as hidden, mysterious, and potentially dangerous.

This particular pictorial metaphor is an opportunity to depart temporarily from the original data set and reflect upon an iSquare made by a renowned information theorist. Marcia J. Bates (2010), the author of a chapter on information in the *Encyclopedia of Library and Information Sciences*, created the iSquare in Figure 8, which reflects information as a box. By using double lines to mark all edges, Bates sought to depict the shape of the objects, not the objects themselves, thereby enacting her favorite definition of information as "the pattern of organization of matter and energy" (Parker, 1974, p. 10; Bates, 2010). In "The Invisible Substrate of Information Science," Bates (1999) argues that information science is a meta-discipline, of a higher conceptual order than other disciplines. In that spirit, it appears she has tried to draw a meta-box and a meta-key on the iSquare.

5.6 Information as a cloud

Another recurring pictorial metaphor is information as a cloud. There are many kinds of clouds and to be precise, the drawings are puffy, roundish, cumulus clouds that float low in the atmosphere during fair weather. In most cases, a cloud appears singly and centered on the page. Alternatively, there may be a constellation of clouds connected with lines, and these resemble the aforementioned pictorial metaphor of information as

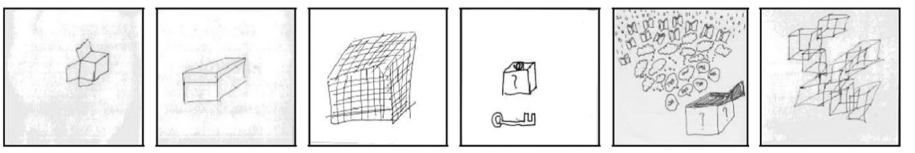
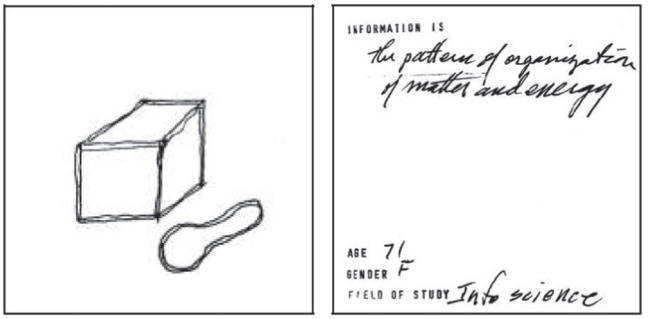


Figure 7.
Information as a box



Notes: Drawn by Marcia J. Bates (left). The back side (right) shows her favored definition of information

Figure 8. iSquare drawn by Marcia J. Bates, of information as a box

a web. Sometimes, markings around and through the cloud's perimeter suggest an information process is underway (Figure 9).

As a source domain, clouds have many striking features that are easily lent to information. Clouds can change shape rapidly, indicating that information is subject to constant change. Though drawn simply on the iSquares, clouds can be multi-layered, suggesting that information is a complex phenomenon. Clouds may be portents of sunny or stormy weather, just as information may give rise to pleasure (Fulton, 2009) or anxiety during the information search process (Kuhlthau, 1991).

For a long time, clouds have been associated with thought and states of mind. In cartoons, cloud balloons are "carriers" (Cohn, 2013) placed over a character's head to reveal its thinking. "Cloud nine" is a state of bliss; being "cloudy" refers to confusion and melancholy; and having one's "head in the clouds" means an attachment to fanciful ideas. Altogether, this pictorial metaphor associates information with many aspects of human consciousness. A cloud may be a resonant logo for information research based upon cognitive metatheory that is centered upon mental constructs such as Brookes' (1980) Fundamental Equation of Information Science.

Information as a cloud also invokes cloud computing and like information as a web hints at the structure of information. Cloud computing is the practice of using a network of remote servers hosted on the internet to store, manage, and process data, rather than a local server or a personal computer. First there was the "web" and now the "cloud." One can only wonder, how might our information environment be metaphorically envisioned next?

5.7 Information as fishing/mining

The pictorial metaphor of information as fishing/mining groups together two distinct activities that involve the extraction of an object from nature. In the images of fishing a person holds a fishing pole in the water and awaits a catch. Mining is shown in diverse

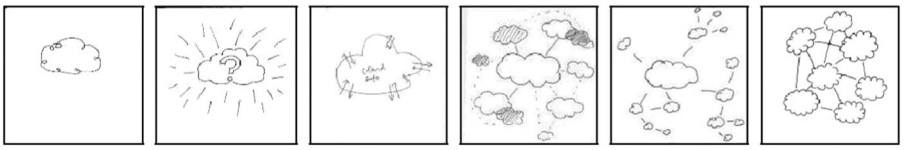


Figure 9. Information as a cloud

ways, as: a figure striking a rock with a pick axe, a piece of coal turning into a diamond, and an artifact buried under layers of earth (Figure 10).

Compared to all the other pictorial metaphors, information as fishing/mining is more dynamic because it casts information as a verb, not a noun. In the first image, the procurement of a fish or mineral from the sea or earth, respectively, is likened to the acquisition of a fact, document, or knowledge from the information environment. This pictorial metaphor may be seen as an artful, rudimentary model of information retrieval, information seeking, and information searching in which the user, tool, resource(s), and context are given form. When viewed, there is a subtle sense of anticipation as we hope, alongside the actor, to catch a big fish or find a beautiful diamond.

Information as mining echoes data mining, the computational process of discovering patterns in large data sets (Han *et al.*, 2012). It also resonates with one of the most popular definitions of information, the DIKW sequence, which is sometimes shown as a pyramid (Rowley, 2007). In this formula, Data are a raw material that is incrementally refined into Information, Knowledge, and then Wisdom, just as ore is smelted into more valuable base elements like copper, iron, and silver. In all these cases, information is a natural resource embedded in the world and the precious reward of patience, hard work, and good luck.

5.8 Information as an eye

Across the iSquare corpus, though not in this data set of 417, students envisioned information as an eye. We felt this striking pictorial metaphor deserved some attention, given its prevalence in other lines of iSquare research. In its simplest form the pictorial metaphor shows a single eye with its retina and pupil. A more elaborate version places a pair of eyes on the face and suggests other senses, too. Typically, the eyes are open wide, though one set is closed in contemplation or sleep. While many creatures have eyes, those drawn by students are human (Figure 11).

A pictorial metaphor of information as an eye aligns information with the organ responsible for human sight. Technically speaking, eyes detect light, convert it into electro-chemical impulses, and transmit these signals along the optic nerve to the visual cortex of the brain. The process of visual perception is experienced powerfully as intellectual perception or knowing. Despite this intuitive association, there is little work in the information science literature that explores the relationship between information and sight, with the exception of studies of information seeking by blind and sight-impaired people (Williamson *et al.*, 2000).

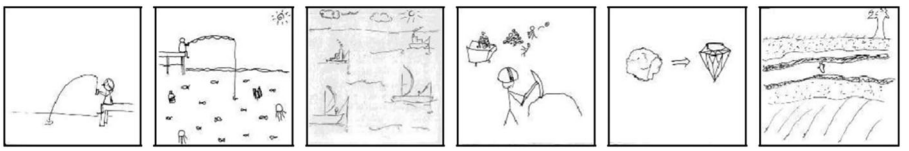


Figure 10.
Information as fishing/mining

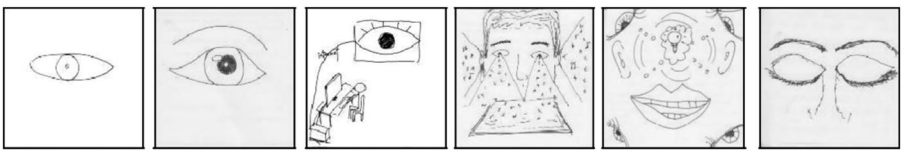


Figure 11.
Information as an eye

The depictions by students resemble many iconic eyes that lend additional positive meanings to information. The Egyptian wedget eye signifies protection and life and in New Age spirituality a third eye symbolizes higher consciousness. Indeed, eyes are associated with focus, clarity, prophesy, omniscience, presence, intelligence, observation, and awareness – all qualities, dimensions, or impacts of information, too. The negative aspects of information as eye is when information is used in surveillance (Lyon, 2001); Big Brother is watching you!

6. Discussion

6.1 Summary answers to the research questions

The first research question asked:

RQ1. What are the main pictorial metaphors used by iSchool students when expressing information as a drawing?

The most common pictorial metaphors were Earth, web, tree, light bulb, box, cloud, seedling, sun, sea/boat, dot, mountains, path/journey, city, and fishing/mining. Most of the pictorial metaphors were inspired by the vast source domain of nature.

The second research question asked:

RQ2. What are the formal qualities of these depictions?

Here, we describe what was drawn by students and how it was drawn. Students generated canonical (Picard and Durant, 2005) versions of objects in the world, leading to arrays of pictorial metaphors that are stunningly similar. The tree, cloud, and light bulb, in particular, are rendered with remarkable consistency. Such quintessential graphical forms are sourced from popular culture and art, imprinted during childhood drawing experiences, and carried into adulthood as drawing strategies. The pictorial metaphor of fishing/mining is an example of an image that lacks a canonical form and leads to more diverse iSquares. In terms of their complexity, most of the pictorial metaphors are elementary graphic objects (Engelhardt, 2002) and relatively simple; fewer manifest in composite graphic objects with many components. Some images were made more comprehensible through the liberal handling of occlusion; features were shown that would normally be obscured (e.g. fish were drawn in the sea or a filament displayed in a light bulb). The artistic ability ranged from high to rudimentary and all featured the firm and precise line typical of ink drawings (Taylor, 1957).

The third research question asked:

RQ3. What makes the resulting pictorial metaphors suitable for conceptualizing information?

Overall, this survey of pictorial metaphors for information provides an alternative and complement to the myriad conceptions of information based upon words. The outcomes may appeal to people with strong humanistic or artistic sensibilities who instinctively approach information in a non-textual manner. The work may be welcomed by anyone who finds the existing theoretical literature on information to be hard to grasp, thereby achieving the arts-informed objective of being accessible to non-experts.

Existing conceptions of information locate it in a contemporary context and ignore history, especially what has come to be known as big history that spans eons. Yet the pictorial metaphors invoke the primeval story of the tree of knowledge, the myth of Pandora's box, and the ancient Egyptian symbol of the wedget eye. These enduring and powerful ideas bring a propitious depth and gravitas to our sense of information

and likewise to our discipline. Further, as pictures, these age-old motifs are more easily recognized transnationally (Forceville, 2008); in a universal spirit they associate information with the broadest of all communities-humankind.

Advantageously, the pictorial metaphors bring nature into the conversation about information. In Bates' (2010) review of seven major types of definitions for information, most cast information in abstract conceptual space, and only the "evolutionary" perspective mentions our planet and its life forms. Yet the foremost pictorial metaphor was the Earth, and other images reference our planet's flora, fauna, as well as its land, sea, and sky. The invocation of nature is important because right now our planet is at its most vulnerable, though is seemingly irrelevant in information science scholarship.

Finally, the pictorial metaphors for information have a "perceptual immediacy" and a "stronger emotional appeal" (Forceville, 2008) than verbal metaphors or other purely linguistic devices, such as definitions. Indeed, some of the images come across as exclamations about information and could be translated into words as follows: information (as the Earth) … is big! information (as a web) … is tangled! Information (as a box) … is mysterious! Such expressive visual motifs beneficially infuse the rational and staid tone of most conceptions of information with a welcome vitality. In our opinion, Elfreda Chatman is a singular information scientist who similarly is willing to explore the crossroads of information and emotion.

The work also helps to enrich the small body of metaphor-related research already published in information science, such as studies of metaphorical conceptions of the internet (Savolainen and Kari, 2004) and metaphorical strategies for information management by historians (Case, 1991), among others. Perhaps buoyed by the work at hand, metaphor may emerge as a new topic in information science and innumerable unexamined metaphors like berrypicking (Bates, 1989) and small worlds (Chatman, 1999) will be thoroughly and creatively problematized.

This study also extends information science research into the lively interdisciplinary conversation about CMT and pictorial metaphors that exists across the social sciences. To our knowledge, in this literature ours marks a new research design that uses the draw-and-write technique to reveal source domains, and it may be adopted by other social scientists. It is always beneficial for information science as a field to export ideas rather than import them. Within the CMT literature, our paper may serve as a boundary object (Star and Griesemer, 1989) that introduces information as a research topic, discipline, and profession to other scholars.

6.3 Pictorial metaphors and information science education

The idea of pictorial metaphors for information can benefit information science education. Almost all information programs, whether geared to undergraduates, masters, and doctoral levels, devote attention to the nature of information, usually during the first semester. A typical pedagogical strategy is to read seminal papers by Buckland (1991) or other theorists. Here, it must be underscored that the literature on information contains philosophical discourse that may be confounding or off-putting to newcomers.

Instead or in addition to reading seminal works, our approach affords an opportunity to introduce information in a more playful, interactive, and accessible manner (Hartel, 2014b). For example, on the first day of class, students may be asked to draw a pictorial metaphor for information and then discuss or write about the meanings of their own and/or their classmates' renderings. The learning experience can be enlarged by having students ask their family and friends to draw a pictorial metaphor for information, too, enacting the arts-informed mandate to engage beyond

the academy. Such activities and ensuing discussion can bring new insights and opinions about information into focus. It would be interesting, as well, to collect another drawing from each student at the conclusion of the course, to see whether students' visions of information may have changed.

The classroom discussions can include the rudiments of CMT, so that initiates to information science become better versed, not only in information, but in a widespread social scientific theory. The insights and images generated during the activity – of information as a tree, web, or light bulb – can be carried through the semester as unifying visual motifs sprung from the very minds and hands of the student participants and their social worlds.

6.4 Pictorial metaphors and information science practice

As arts-informed visual research with a theoretical bent, it may be beyond the capabilities of this study to provide immediate solutions to problems of information provision or design that challenge information science practice. However, the work has impact and value to the vital matter of professional identity. Myriad professional groups fit under the banner of information science and each has its own mission, values, and practices. Sometimes these elements of professional identify are expressed in explicit statements made of words; more often they lurk unarticulated as an elusive and vague "invisible substrate" (Bates, 1999). We proffer that the deeply set qualities of different practice communities may be captured in pictorial metaphors.

To demonstrate: each pictorial metaphor seems to embody the spirit of a singular information profession. For example, librarianship is affiliated with information as tree, because of its roots in the past; ability to transfer information and knowledge across levels of society; and soaring defense of democratic values such as intellectual freedom. Differently, archives and record management is channeled in information as box, which acknowledges (like Pandora) the potential hazards of some kinds of information being set free and has a long-standing practice of storing paper documents in archival boxes. The domain of information architecture is reflected in the pictorial metaphor of information as web, since these technicians are foremost concerned with information structure and manage web-like networks of information that sprawl through organizations.

During a student's initial training or later at a professional development event, drawings of information can be solicited, examined, and discussed. When pictorial metaphors appear, devotees will then be better able to picture, understand, and articulate the invisible substrate of their work, thereby fortifying commitment and sharpening work performance.

7. Conclusion

The arts-informed, visual research at hand applied cognitive metaphor theory to document the pictorial metaphors that appear in visual conceptions of information. In line with social science practices, a systematic process was followed to isolate a sample and analyze the images. At the same time, an artistic philosophy sanctioned intuitive strategies to organize, interpret, and present the findings for maximum impact. Now thoroughly characterized, the pictorial metaphors for information provide a creative complement to written conceptions of information and bring a greater sense of history, humanity, nature, and beauty to our understanding of information today.

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