Informing About Semantic Information: A Set of Exercises and Lessons Learned

Full Paper

Earl H. McKinney Jr.
Bowling Green State University
emckinn@bgsu.edu

Charles J Yoos II
Fort Lewis College
yoos_c@fortlewis.edu

Abstract

Information is a ubiquitous term that in both academic and practical settings is taken seriously while used carelessly (Lee 2010; McKinney and Yoos 2015). While used poorly, a growing number of recent publications on information identify the importance of the term for both IS research and practice (Boell and Cecez-Kecmanovic 2011; Floridi 2011; Kettinger and Li 2010; Mingers 2013). While the academic community is now engaging the topic, most students are unaware of how they become informed. We believe informing is related to meaning, that information changes a mind. To help students understand the implications of this semantic aspect of information we have developed a number of classroom exercises. We've used these exercises with freshmen, EMBA students, and in management, statistics and MIS courses at three institutions and in small and large lecture formats. This paper introduces these exercises. It is organized from shortest and simplest exercises to longest and most complex. In turn we briefly describe semantic theories of information, criteria we use in designing the exercises, the exercises themselves and lessons learned.

Keywords

Information, Meaning, Semantic, Exercises

Information

Information is a term central to a wide range of pursuits—biology, physics, economics, psychology, learning, sociology and business. To arrive at conceptions of information, each of these fields makes different assumptions about reality, individual behavior, and adaptation; and each pursues different problems. As a result, information takes on various forms.

To better understand information, a number of authors have constructed taxonomies that classify theories of information in different ways (Boell and Cecez-Kecmanovic 2011; McKinney and Yoos 2010; Mingers 2013). One of the most common classification attributes differentiates theories of information as either physical or semantic, in more informal terms—external to the individual or internal. Physical theories, common to the natural sciences, engineering and the hard sciences include Shannon's Mathematical Theory of Communication (Shannon and Weaver 1949), and genetic information in biology and entropy in physics. Semantic theories, more common in the social sciences, include semiotics, representationalism, DIKW and the difference theory.

The exercises we present in this paper enable students to better understand the semantic nature of information. We do not typically teach the details of semiotics, representationalism or DIKW, simply that information includes an element of meaning to it. It is more than data, it involves interpretation and meaning. We'll discuss the essential characteristics of semantic information after a brief review of physical information.

Physical information is objective. It is a thing (what is the information?) that can be located (who has the information?) and delivered (send me the information.). The most common physical-objective theories of information assume information exists independently of an individual’s observations of it, and commonly relate it to entropy or the organization of energy or matter (Shannon and Weaver 1949; Weaver 1961; Wheeler 1990). Most of these theories stipulate that information must be true, it must...
correspond to the real state of affairs of the world. Physical-objective use of information in IS typically
equate information to data to explain how information is processed by individuals and machines.

A number of theories of information link it to semantics (Boland 1987; Checkland and Holwell 1998;
Dretske 1981; MacKay 1969), that information is associated with meaning, an inward forming (literally in-
forming). Boland (1987) sums it well—it is the change in a person from an encounter with data that
changes knowledge, beliefs, values or behavior. In the commonly used DIKW hierarchy (Ackoff 1989;
Kettinger and Li 2010; Zeleny 1987) information is the meaning of sensory stimuli. Semiotics and
representationalism also link meaning and information—information is created when an individual
applies a sign to an object to create meaning.

Elsewhere we proposed a new semantic theory of information called the difference theory (McKinney and
Yoos 2015). While semantic, it is also subjective. It holds that people perceive salient differences in
complex, uncertain environments and conceive information by using criteria.

To be sure, there are significant differences within these semantic theories. However, to ease
communication with students, we typically distill two common characteristics. First, information implies
meaning. Second, the meaning an individual conceives is likely different from the meaning other
individuals conceive. At times these meanings can be minor and intersubjective agreement is assumed,
but at other times these differences can be significant and surprising.

In this paper we present several pedagogical exercises that we use to enable our student to inform
themselves about the semantic nature of information. We use these exercises in many different courses as
we find them helpful to explore the implications of informing in different contexts.

Criteria for Our Exercises

Before we present the exercises, here we briefly describe the criteria we used to select, improve and retain
them.

1. **Provoke internal feedback within the student** that the student interprets. These exercises confront
students with their own meaning creation process; this process spurs reflection about how they create
meaning and inform themselves. These exercises help provoke insight about how the student becomes
informed, and these new insights become the focus of the student’s reflection and subsequent class
discussion. For example, the question, “Why is the building in this picture beautiful to you and why?”
creates internal feedback such as “Why do I consider buildings beautiful or not”.

2. Demonstrate the **uniqueness of their own informing**, and the informing of others. Each exercise
should help the student recognize that the meaning they create is to some extent unique to them. For
example, a teacher walks out of the room and on returning asks the students to write down two or three
reasons why the teacher left. Students notice that their attribution of meaning can vary from others who
observed exactly the same event.

3. Raise awareness of the difference between **analyzing** the world and **engaging** the world. These
exercises should help students recognize the difference between a studied abstraction from a
dispassionate, **observing**, objective viewpoint and being **thrown** into contexts. Kierkegaard once wrote
that life is lived forward but understood backward. Most class discussions analyze by looking backward at
an experience. On the other hand, these exercises are designed to simulate engagement and active
participation, a throwness where provocation, passion, commitment, change and engagement, are
common. Here emotion plays a role, or better e-motion as participation creates its own flow, motion and
momentum, there is no opportunity to get away from the engagement and dispassionately analyze it.

Exercises

Here we describe the five exercises listed in Table 1. Following the Table we describe each exercise, our
goal, the steps we use, reactions from students, and discussion topics.
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**Table 1. Exercises and Goals**

**Aesthetics—Architecture**

**Steps:** Select a variety of real-world architectures. Project each of them in front of the class of students. As each one is viewed, ask the students whether they behold it as beautiful or not, and why or why not. We use images of Notre Dame, the Pyramid at the Louvre, Frank Lloyd Wright homes, the Sydney Opera House, cave dwellings and local landmarks. Some are acclaimed as beautiful, others not, and some a matter of opinion, in which cases it is fascinating to explore why there are differences of opinion—differences in semantic information—when the data, the photo, is the same for all students to see.

**Reactions:** Like other forms of aesthetics, such as art and music, students have visceral, passionate, reactions to architectural forms—they know what they like. But it is more difficult for them to articulate why—what is it about, say, a building, that makes it beautiful or ugly to them?

**Discussion:** As they attempt to account for their feelings, we listen for any insights into architectural criteria that pertain to balancing what is familiar in the design with what is new, what is comforting with what is exciting. Use their aesthetic appreciations to better understand the role of sameness and newness in information and how assessments of sameness and newness vary from student to student.

**Goal:** Enable students to appreciate the realm of aesthetics as information, and specifically to recognize that beautiful information balances familiarity with novelty. This technique explores the aesthetics of information through architecture.

**Primer Pages**

**Steps:** Prepare a series of one-page papers on intriguing topics (which we call Primer Pages), two examples are included in the Appendix. Present them to the students; tell the students that they are in no order, and so may be engaged as the student wishes. Primer pages should be presented as a set, not one-by-one, as an out-of-class assignment, with the expectation that the students will share insight in a succeeding class. Each Primer Page concludes with “Questions to consider,” to engage thinking.

**Reactions:** Initially, the students are puzzled by an assignment that has minimum structure, and even frustrated by not being told what it is they are to understand. Some students “get it,” and offer cogent insights. Others are diligent, and open to insights. A few are frustrated, and resist insights.

**Discussion:** In the initial class discussion it is vital that the Professor facilitate, initially encouraging brainstorming, then calling to the students’ attention those insights that have a bearing on the semantic aspect of information. Even so, most student’s grasp of the meaning of the primer pages will be tentative, and so it important that the insights be recollected and reinforced later as the occasion enables.
**Goal:** Provide students a smorgasbord of food for thought about the semantic aspect of information, from a diversity of contexts and perspectives, to prime thinking without regulating or organizing it. It is incumbent upon the students to ponder each of them individually, and all of them together, to inform themselves with some passion as they engage that internal feedback.

**Diagrams with “Six” differences**

**Steps:** Prepare an answer sheet to distribute to students. This sheet has numbers 1 to 6 with blanks after each. Distribute the sheet and show the class a two-panel drawing of the same scene, with ten to twelve differences as in Figure 1. Tell the students to find and write down THE six differences. Students do the assignment in teams or individually. Tell them they have one minute. After the minute is over, display the same two-panel drawing with the 10 to 12 differences highlighted.

![Figure 1: Example of Two Panel Drawing](image)

**Reactions:** The activity is engaging and virtually all students passionately participate. Almost all students stop after finding six differences. They are surprised and amused when they discover they only found half the differences.

**Discussion:** After the exercise we draw the comparison between the data that is the artwork on the drawings and the data on a sheet of paper the teacher has in hand. We describe a business scenario where a marketing associate is trying to explain sales data, like the data in hand, to other managers. The associate is surprised that the other managers do not see the same “six” differences that she sees, they may see some of her six, but will find others that make a difference to them. We explain that in authentic business settings there is a complex set of elements that change and are ambiguous, that the semantic information available in that setting exceeds most imaginations.

We also use the exercise to point out the value of curiosity, of staying engaged. Too often students and business analysts stop looking for meaning when they have found the only “six differences”.

We also use this exercise to explain the need for vocabulary to create semantic information. If the managers listening to the sales associate do not understand demographics, market basket analysis, lift or other vocabulary, they cannot conceive what the sales associate is describing. They can perceive the numbers but cannot conceive with them, they cannot create useful meaning, their minds do not change.

**Goal:** We pursue three objectives: Students will better understand 1) the constraining effect of the view that data is information, 2) that information can be created but is not transmitted, and 3) that there is more uncertainty than first appears. This is an exercise where each student will see different differences and stop when they mistakenly believe they have all the necessary information. Our goals is that when students engage their world outside of class that will seek and expect more information than before.

**Journal Writing**

**Steps:** Students write periodic entries into a journal about course topics, all journals are returned with comments and a conspicuous checkmark on the top. Early on students (misinform themselves) this checkmark is a type of grade. As the semester progresses they get the same checkmark every time. The teacher provides no explanation.
Reactions: Some students begin to apply the course concepts of semantic information and realize they have created an inappropriate meaning for the checkmark. They come to realize that in a course that emphasizes the uniqueness of informing, that teacher evaluation of that informing is problematic. Some students “rebels” and ask us not to “grade”. They realize that this type of constraining misinformation is not uncommon and that the evaluation of the journal, and more largely their education is really up to them.

Discussion: The exercise typically involved two discussions. The first, early in the semester centers on what the journal should include. The second discussion typically has two parts. The first part is the A-ha moment when students realize they should have noticed that the course was designed for them to take responsibility of their own informing. Some first reactions of students to the absence of a rubric is that they will write anything they feel like writing. This quickly gives way to an understanding that they have their own educational goals and that they should write journals that help them inform themselves.

The second discussion generalizes this insight to other experiences. Students reflect on constraining misinforming in other contexts. They also appreciate the need for active, engagement of learning—being thrown by their own will into learning, in contrast to passively receiving learning checkmark scores given by teachers.

Goal: Provide students an opportunity to “misinform” themselves and to take responsibility for their own informing.

Sending the “Whatever” text

Steps: We ask students to text a friend with only three words to “arrange something”. After ten minutes we ask the students to read their responses from friends. We ask the group how many are confident that the arrangement they tried to convey was understood as intended.

Reactions: Students actively engage. Most initially do not see where the exercise is heading and they are confident their message, their meaning will be conveyed accurately. When they observe the reactions from friends, many are surprised how “dumb” their friends are, but when other students in the class have the same reaction from their friends as well, students begin to question how often their messages are “misunderstood” and about the uniqueness of meaning.

Discussion: We make the claim that data is what is exchanged between people; that semantic information is only inside of them, the result of interpretation. Therefore when they text someone, the text is data. Often we attribute our interpretation of the text to the text itself, not realizing that when we perceive data we naturally create our own information from it. Students expect that others will interpret their data, the three word text, the same way sender intended. As a result, students better understand “misinterpretation”.

Goal: Help students understand that communication requires meaning and semantic information and that data can lead to different informing.

Outcomes—Desired Change in Students

These exercises can be used to pursue a number of educational outcomes. Here we describe the four outcomes we currently use. For simplicity they are written here as they would appear in a syllabus or class exercise.

Understand the Difficulties of Effective Communication

If information varies from person to person, we should no longer say, give me the information. I can try to give you my information, and you can try to give me your information, but in both cases data is given and received, not information. Communication is not the delivery of information, communication can convey data, but to be informed, an individual must create or interpret signs and differences.

Understanding How to be Effective on a Team
To help your teammates conceive useful information, provide data that they do not already know so they have the opportunity to inform themselves. Ask them to share with you data that have meaning to them so you can inform yourself. Also, ask questions that reveal new data. If your questions are original and insightful, then others on the team can use your questions to inform themselves in future settings.

**Understand the Value of Uncertainty**

Most students assume the intellectual posture that problems have a finite or given amount of information. They believe that if they would get that information they will be done. Many academic exercises reinforce this—read a case study, use the "information" there and make a decision. In contrast, we believe the chief characteristic of the authentic business context is that the uncertainty is infinite, the potential data is overwhelming and very little information is ever created from it. The more uncertainty in a context, the more semantic information can be conceived. Our educational outcome is for you to appreciate the value of uncertainty in actual business contexts and recognize the opportunity it presents for you to inform yourself.

**Understand the Value of Curiosity**

If information is inside of you, the only way to get it there is for you to put it there. Information can't be received; it is made. The creative effort of conceiving information is fueled by curiosity. When you quit being curious, you quit informing yourself. Realize every day that other people are informing themselves and seeing things you do not. The only way to keep up is to create information for yourself. Stay curious, you were born that way.

**Lessons Learned and Limitations**

We have distilled some of our experience using these exercises to the following lessons learned and limitations.

**The exercises are typically well received**

These exercises are typically well received and engaging to the students. They are sufficiently simple to execute with minimal preparation. We have been told by students that they appreciate the shift from the traditional delivery of knowledge format to this participatory method. Further they tend to agree that they have not reflected sufficiently on their informing process.

**Students understand but struggle to apply the lessons**

Many students report that they appreciate and understand the educational outcomes reviewed in the previous section; however, they struggle to make them habits. Students often report they have learned; however, what has been learned is typically factual—information requires interpretation or that need to inform themselves. They soon revert to previously learned perspectives and routines. As one bright student aptly said, “You’re asking us to change a lot.” Unless these lessons are frequently reinforced, successful outcomes are difficult to sustain.

**The exercises are difficult to assess using traditional methods**

Most methods of assessment focus on knowledge retention not experience, exposure or reflection. These exercises are like field trips, guest speakers, and self-reflective essays which the assessment community have always found valuable but difficult to assess.

**Our own experimentation is vital**

We believe one of the most powerful teaching techniques is to demonstrate how we employ our own understanding of information. We extol uncertainty and the opportunity to inform in it. As a result we deliberately vary the delivery and discussion of these exercises. We seek to display the curiosity and experimentation we ask of our students.
Conclusion

These exercises are offered to help your students become more aware how they become informed and the usefulness of a semantic aspect of information. We described the semantic aspect of information, presented several examples and provided some of the lessons we have learned when using these exercises. We expect that in using these examples and observing your students you will inevitably inform yourself about the exercises, and the semantic aspects of information.

Appendix

Primer Page: Dyed-in-the Cloth Knowledge

One of us (hereinafter I) just moved into a new Building at College this year, with white (not black, not green) boards. I discovered that the dry erase markers approved for use on the white boards leave marks that are not entirely erased by the approved erasers, so I obtained some approved whiteboard spray cleaner, and a cloth rag—a remnant of white T-shirt—to do the proper job. (By the way, the spray tends to leave a noxious odor in the room, further demonstrating life’s sometimes annoying complexities!)

I’ve used the cloth all term, in several classrooms, erasing what both I and other Professors have written. We use black, blue, red and green markers, so the cloth has acquired a multi-colored tie-dyed appearance. Since it has continued to wipe clean, I have not discarded it, but indeed have been curious to see how much it would absorb—so far, everything.

One morning, as my class ended and I was dutifully spritzing and erasing, I got to thinking—this cloth has absorbed some great knowledge! I mean, I like to think that my schema of Burrell and Morgan’s sociological paradigms for organizational analysis would alone grace such a cloth, but also there’s, say, my keen exposition (if I do say so myself!) of Coase’s nexus of contracts approach to corporate social responsibility, not to mention my derivation of the F ratio, simultaneously mathematical and symphonic (I show that an orchestra warming up is really ANOVA). And that doesn’t even consider the many brilliant forms of knowledge my distinguished colleagues put up, that me 'n the cloth have mopped up.

The students who had arrived early for the next class were settling in . . . I couldn't help myself! I asked them to regard the cloth, and consider its great value. If good knowledge was on the board, and the cloth had taken it off, then it all was now in the cloth!

Aha! Some students had better things to do, but a precious few took it up with me. One in particular was fascinated; at one point—and I swear I am not making this up—he said, "But, it’s not knowledge now, because it is not in formation!"

The remnant is framed, and displayed on my wall...I haven’t settled on the title yet; perhaps the title above. Every term from now on, I will start out with a clean white shirt, and use it all term. At the end, I shall auction it off for charity, or present it to a retiring colleague.

You know what? I can’t look at that rag in quite the same way ever again....
Questions to consider

One colleague suggested to me (the professor involved) that I should put the cloth through the washing machine! Should I choose a “delicate” cycle? From an information standpoint (not a chemical or hygienic one!), how would you describe the state of the knowledge cloth after having been washed?

Primer Page: Preplay, or Replay?

How do sporting event officials do it? In fast sports (baseball, football, basketball, soccer, hockey, etc.), officials (referees, umpires) continuously and instantaneously interpret comprehensive and complicated rules, rendering split-second, on-the-spot judgments that often are important to the outcome of the game. And even though they occasionally err, by all accounts most officials make the right call almost all of the time. How do they do it?

Yes, they are trained and experienced. But the premise that in each situation, the official quickly evaluates exactly what just happened, mentally selects and applies the appropriate rule(s), and reaches a discrete conclusion, defies virtually everything we know about human mentality. In short, it’s impossible!

Rather, like all humans in all situations, they are constantly engaged in the process of constructing meaning (Information) by discerning difference within a pattern that they (have learned to) recognize. And to do that at the speed of play, they keep in their minds a dynamic pattern (a movie, not a snapshot) of how a play develops and continues; in effect, some expectation about what will happen, before it does, or doesn’t, actually happen. Thus, the official’s judgment represents recognized deviation—difference from the patterned expectation—not a conclusive evaluation of the instant circumstances.

To better understand this perspective, consider the so-called “instant replay” process once and again being used in the United States’ National Football League (NFL), whereby certain calls by the officials may be challenged by the coaches, and then are reviewed via videotape by the head game official, with the criterion for the call to be overruled being “incontrovertible visual evidence” of error.

It’s interesting to contemplate: knowing of this possibility, do officials consciously or even unconsciously alter their officiating? After all, nobody likes to be overruled! And of course, the most regrettable error would be one which prevented one team from scoring, blowing the whistle to stop a play which results in a touchdown. If the whistle isn’t blown, and instant replay incontrovertibly shows that it should have been (perhaps a ball-carrying running back stepped just out of bounds on a touchdown run), then the situation can be rectified, but not the other way around (i.e., if the whistle is blown, the play is stopped, and even if the running back goes into the end zone, no touchdown can be allowed, even if the replay clearly shows he did not step out of bounds).

Jerry Seeman, the NFL’s senior director of officiating, thinks not. “Replay doesn’t change anything. If you’re not sure, let it go. If you’re going to blow that whistle, you’ve got to be able to sell your soul that you’re right.” ¹ In other words, officials have always enacted a difference process, and in particular, one that minimizes the possibility of irreversible error.

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¹ USA Today. Friday, January 28, 2000, page 2C.
Consider your favorite sport, and how the rules are applied. We dare say you will realize that the official—whether or not replay is permissible—is not a “comprehensive situation evaluator,” but rather a “pattern deviation recognizer”—how do you like those job titles!

Questions to Consider

With this awareness of how sports officials operate, how might an athlete adapt his or her play to increase the likelihood of getting a favorable ruling?

REFERENCES


