

# What is Information? Tiptoeing Towards The Philosophy of Information Systems

*Full paper*

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## Abstract

The Philosophy of Information Systems should define the components of the field and how knowledge is developed, advanced and justified. This is a bold undertaking but begins with establishing a definition for information which can provide a foundation for further definition of the field. This paper addresses the question – What is Information – and, in doing so attempts to define a core component of the field. In order to do this, we must pull away from an established definition provided by Claude Shannon and see information in a broader context as anything which ‘informs’ us, or more specifically, helps form our internal conceptual models of reality. .

## Keywords

Information, Philosophy of Information, Philosophy of Information Systems

## Introduction

An earlier paper on the Philosophy of Information Systems (Artz, 2013) attempted what proved to be an absurdly ambitious task when it sketched out the essence of the field of Information Systems from a philosophical perspective. The rationale given for the ambitious undertaking was the necessity of providing a core to the field of Information Systems in order to preserve it in the face of rapid change in both technology and the evolution of ideas. Perhaps a more conservative and hence more reasonable approach would have been to create building blocks and bring those building blocks together at some point in the future. Those building blocks come from asking the following questions: 1) what is information?; 2) what is an information model?; 3) what is an information system?; and 4) how do we advance our knowledge of information systems in a rigorous, productive, and reliable manner? The purpose of this paper is to provide one of those building blocks by focusing on the question – What is Information?

## Background and Context

Perhaps the main contribution of the earlier paper on the Philosophy of Information Systems was the focus it provided on what we mean by “The Philosophy of X”. The Philosophy of X covers a wide variety of fields. Some are familiar such as the philosophy of science, the philosophy of social science, and the philosophies of law, art and literature. Some are less familiar such as the philosophies of mind, religion or computer games. What constitutes the Philosophy of X can be summarized as follows:

“This is to say that you need the philosophy of x to arrive at the contents of the field, to describe how knowledge is developed and advanced, and how knowledge is justified and/or validated.” (Ibid. pg. 3)

Being, still, in the early stages of the evolution of the field of information systems it would be nearly impossible to articulate, in a uniform and cohesive manner, how knowledge is developed and advanced, nor how knowledge is justified and/or validated. It is enough, at this stage to clearly identify the contents of the field. The field of information systems is about information systems. But that doesn't get us very far. While there may be numerous definitions of information systems, there is no consensus definition. And while exploring those various definitions and their implications would be interesting and possibly revealing, it is beyond the scope of this paper. For this paper we will step back a bit and stipulate that information systems are systems involving humans and computers for the purpose of processing information and leave any derivations or clarifications of that for future explorations. Instead, we will focus on information and ask the question – What is Information?

## What is Information?

The answer to the question – What is information? – is perhaps one of the most difficult and critically important elements in the Philosophy of Information Systems. On one hand we have a widely used, and entirely inappropriate, definition provided by Claude Shannon (Shannon and Weaver) which we need to overcome. On the other hand, we have what one might call conversational uses of the term which confuse the issue even further. Somewhere in between the over specified and overly technical definition provided by Shannon and the vague imprecise definitions in the dictionary we must find a definition that is both precise enough and appropriate enough to serve as a foundation for the Philosophy of Information Systems.

Let's begin with a definition from The American College Dictionary which has seven parts to it:

- 1) Knowledge derived from study, experience, or instruction,
- 2) Knowledge of a specific event or situation; intelligence or news,
- 3) A collection of facts or data: *statistical information*,
- 4) The act of informing or the condition of being informed; communication of knowledge
- 5) *Computer Science* Processed, stored or transmitted data,
- 6) A numerical measure of the uncertainty of an experimental outcome,
- 7) *Law* A formal accusation of a crime made by a public officer rather than by a grand jury indictment

[nb. The definition is not in quotes because it was lightly edited to remove distracting dictionary notations] Nonetheless, several enlightening observations can be drawn using this definition. First, one would think that a word as common as 'information' would have a clear, precise and agreed upon definition. Nothing could be further from the truth. The online Merriam Webster dictionary (<http://www.merriam-webster.com/dictionary/information>) has four definitions the second of which has four sub-definitions. There is overlap with the definition above and inconsistencies as well. The Wikipedia article on information (<http://en.wikipedia.org/wiki/Information>) begins by defining information, almost tautologically as "that which informs" before embarking on clarifications which do anything but clarify. As we shall see shortly the definition "that which informs" might be the best way to think about information, but some ground work must be laid first.

We can think of these dictionary definitions as A mix of *technical* and *conversational* definitions. For example, four of the definitions (3, 5, 6 and 7) are technical definitions created as the term is applied to different intellectual disciplines. Definition 6 is based on Claude Shannon's definition which will be address shortly. The remaining definitions are *conversational*. That is, they are derived from usage. So, if people typically use the word information in a particular way, that usage becomes part of the lexicon. If an author uses the word in a unique way, that might also be included. These *conversational* usages are problematic for research. As Francis Bacon pointed out back in the 17<sup>th</sup> century in *The New Organon*, accepting terms from conversational usages inhibits the progress of science. Referring to this phenomenon as Idols of the Market place he said

“But the *idols of the marketplace* are the biggest nuisance of all, because they have stolen into the understanding from the covenant on words and names. For men believe that their reason controls words. But, it is also true that words retort and turn their force back upon the understanding; and this has rendered philosophy and sciences sophistic and unproductive.” (pg 48)

In simple terms this says that relying on conversational usages, or dictionary meanings of words, in research, hinders intellectual and scientific progress. This is, perhaps, an even larger problem today as demands for relevancy encourages researchers to avoid arcane definitions and use words in ways that the average person can easily understand. It is a Mephistophelean bargain as we sell our future progress for today's chimerical relevance.

Quite the opposite of conversational meanings of the word information, Claude Shannon went to the other extreme and defined information as a reduction in uncertainty in the transmission of messages.

“That is, information is a measure of one's freedom of choice when one selects a message” [Shannon, C. and W. Weaver, pg. 9]

This is to say that information, according to Shannon, is not about content. It is about possibilities. It is a measure of uncertainty, or, more specifically, the probability that the message received was not the message sent.

So, we are stuck between two unattractive poles. On one end, we have conversational definitions of information which are neither precise nor consistent enough to advance our understanding. On the other end we have technical definitions which, while precise, are inappropriate for the task at hand. Having, hopefully, disabused anyone of the notion that we can simply look up the term 'information' in the dictionary and find a workable definition, we need to look to the other pole and see why Shannon's definition is not workable either.

To understand the basic inadequacy of Shannon's use of the term consider the following simple example. Two neighbors are chatting over a back fence when one asks “What is that lying in your yard over there?” The other replies “It is a dog”. Now consider the ways in which a miscommunication can occur. In one case the neighbor may have heard incorrectly and thought the other had said “It is a log”. Alternatively, the neighbor may have heard correctly, but misunderstood what the other neighbor meant by dog. It could mean the mammal of which there are many types. It could have meant a garden statue of a dog. It could have meant a lawn mower or other piece of machinery that had stopped working correctly. The first case is a technical error. One message was transmitted, but a different message was received. The second case is a semantic error in which the message was transmitted and received correctly, but misunderstood by the recipient. In Shannon's words,

“Frequently the messages have *meaning*; that is they refer to or are correlated according to some system with certain physical or conceptual entities. These semantic aspects of communication are irrelevant to the engineering problem” (Shannon, C. and W. Weaver pg. 31)

More recently, Gleick would add further clarification to this by saying “Shannon needed, if he were to create a theory, to hijack the word *information*” (pg 219) Of course Francis Bacon who was cited above on *Idols of the Marketplace* would say that Shannon was doing exactly what he was supposed to be doing. And he was. It is not Shannon's fault that subsequent readers co-opted his concept and applied it inappropriately. Gleick goes on to say, quoting a more obscure paper of Shannon's “‘Information' here, although related to the everyday meaning of the word, should not be confused with it.” (pg. 219) Shannon, in true Baconian form, cleaned up the word to suit his purposes. There is nothing wrong with this as the restrictive definition created by Shannon was very productive in understanding important mathematical

concepts in the transmission of information. However, it was not long before the restrictive definition, as it gained in popularity, began to pinch.

When Shannon's paper was published in book form, his colleague and co-author Warren Weaver provided an introductory chapter in which he said "The *technical problems* are concerned with the accuracy of transference from sender to receiver of sets of symbols" (Shannon, C. and W. Weaver pg. 40) [n.b. This is the first case from above - hearing *dog* and not *log* when *dog* was spoken]

He goes on to say "The semantic problems are concerned with the identity, or satisfactorily close approximations, in interpretation of the meaning by the receiver, as compared with the intended meaning of the sender." (ibid) [n.b. This is the second case from above not misunderstanding the word 'dog']

Shortly thereafter, in lecture notes, Garfinkle attempted to expand our understanding of information by teasing out greater subtlety and complexity. Those notes were recently published (Garfinkle 2008). The editor states in the introduction

"In Garfinkle's view, it is not possible to adequately apprehend information, objects, or information exchange, without situating objects, meanings, and actions in the ordered social processes that constitute them. Other currently popular approaches that seem to take the situated character of action and perception into account escape into abstraction at some point." (pg. 5)

Shannon does not dodge this issue.

"The word information, in this theory, is used in a special sense that is not to be confused with its ordinary usage. In particular, information must not be confused with meaning." [Ibid. pg. 8]

That is to say, that it is one thing to talk about information sent by one engineered device to another engineered device. It is something altogether different to have the information sent by one human in a particular social context to another human in a different social context. But, in the case of information systems we have information sent by a human in a social context to an engineered device and then retrieved, perhaps in derived form, by another human in another social context.

Floridi wrestles with the meaning of the word 'information' as well. He refers to the question "What is Information" as 'The Elementary Problem' in the Philosophy of Information and says "This is the hardest and most central problem in PI [Philosophy of Information] and this book could be read as a long answer to it. Information is still an elusive concept." (Floridi, 2011 pg. 30) He then goes on to provide seven interpretations of the word 'information' that only slightly overlaps with the seven dictionary definitions and the seventh of which recognizes the role of semantics. In a shorter and more readable volume Floridi falls back to Weaver's definition and provides a telling quote from Shannon's collected papers where he says

"The word 'information' has been given different meanings by various writers in the general field of information theory. It is likely that at least a number of these will prove sufficiently useful in certain applications to deserve further study and permanent recognition. It is hardly to be expected that a single concept of information would satisfactorily account for the numerous possible applications of this general field." (Shannon quoted in Floridi 2010, pg 1)

It is interesting to note that, given the technical precision of Shannon's definition and the general vagueness of conversational definitions, the Oxford Dictionary of Philosophy has a definition for 'information theory' based on Shannon's work, but no definition of 'information'.

So, where do we go to get a definition of information that will allow us to proceed with our exploration of the Philosophy of Information Systems? The answer is fairly simple. We will use the same trick that

Shannon used in that we will ground our definition in common understanding and then refine it for our purposes. Francis Bacon would heartily approve.

First, let's go back to the apparent tautology offered by Wikipedia and explore that further. As was already mentioned, the Wikipedia article on Information cursorily defines information as "that which informs". A closer examination of what it means to inform can be illuminating. So, we must take a step back and examine what it means to inform. Note that the 4<sup>th</sup> definition from The American College Dictionary defined information as "The act of informing or the condition of being informed" Using the American College Dictionary again, we can define inform as "to give form or character to ; imbue with a quality or an essence." An obsolete definition provided by the American College Dictionary provides further insight by defining inform as "To form (the mind or character) by teaching or training". We are tip toeing closer to the essence of information.

The Oxford English Dictionary provides an obsolete definition of information which supports this notion. It defines *information* as: "The action of informing, formation or molding of the mind or character, training, instruction, teaching, communication of instructive knowledge." (pg 944) And it defines *inform* as: "To give form to the mind, to discipline, instruct, teach (a person) to form with knowledge." (pg 943) Information informs you which is to say it forms you inwardly or forms you inside. Avoiding the obvious confusion that may arise with this idea, we can say it forms your inner thoughts or you mind. But what does that mean to form you inwardly?

If one thinks of consciousness as a model of the world (Kaku), then information is the means by which that model is formed. Start with information as primary experiences. Go to information as facts and derivatives. Then, go to information as rules and methods to derive new information, and so on. In other words, information is anything (experiences, facts, derivations, rules, methods, knowledge, etc.) that forms that model in one's head that we call consciousness. If the word 'consciousness' is too esoteric, then think of information as anything that contributes to our understanding of something external to our minds. This can be confusing if one thinks of information only as data. But, our understanding of the external world is informed by more than data. It is informed by derivations of the data and rules governing those derivations. But, our model of the world is also influenced by visual and auditory experiences which must count as information as well.

It is interesting to note that this confusion about the kinds, derivations, and rules governing information is not new. In the 19<sup>th</sup> century, the philosopher William Whewell struggled with the same definition as it applied to scientific theories.

"Whewell sometimes spoke of 'facts' as reports of our perceptual experience of individual objects. However, he insisted that this was just one kind of fact. Broadly considered, a fact is any piece of knowledge which is raw material for the formulation of laws and theories."  
(Losee, pg 108)

Whewell wanted to use the term "facts" to cover anything which informed scientific laws or theories. We are trying to use the same generalization of information to cover anything which informs our understanding of the world. Whewell was concerned primarily with externalized models while we are concerned with internal models. Internal models are both more general and more vague but it bears mentioning that external models may be internalized and internal models, with appropriate rigor applied, can become externalized.

So let us define information as – meaning or knowledge acquired through experience or encoded in symbols or visuals with the expectation that it will be decoded at some point in the future to extract some reasonable approximation of the original meaning or knowledge. And that meaning or knowledge is used to modify that internal model of the world we call consciousness. There is no implied claim that this definition of information is perfect or that it is the last word. However, it is workable enough to allow us to

proceed to the next step which is to define information systems. While Shannon greatly limited the definition of information for his purposes, it is equally as necessary to greatly expand the definition of information for the purposes of this paper and to lay the foundations for a Philosophy of Information Systems.

## **Implications for the Philosophy of Information Systems**

Defining information as meaning or knowledge encoded with the expectation that it will be decoded at some point in the future in order to modify one's internal conceptual model of reality has implications for the Philosophy of Information Systems. First, it limits the scope of information that is relevant to the Philosophy of Information Systems. For example, one might argue that the material world is full of information that was not intentionally encoded by anyone and that is true if we drop back to a conversational understanding of the word information. But, with the definition arrived at here, that kind of information would not qualify as information that could be processed by an information system until somebody collected and encoded it with a purpose in mind having to do with informing the thinking of another person. One might argue that you could think of the material world as an information system, and that might be true metaphorically. But, within the Philosophy of Information Systems, the material world would not count. What then would count as an information system? If a movie maker creates a movie that is intended to inform or even influence the thinking of the audience, that would seem to qualify as information, but does the movie making process qualify as an information system? Clearly, there is more work to do and the next step might be to take this definition of information and see if it can serve as a basis for defining an information system precisely.

On the other hand, while this definition of information narrows the scope of information systems in some ways, it expands it in others. For example, expert systems, statistical models, video games, virtual worlds, web applications, and social interaction technologies all contain information of kind defined here and thus may fall under the purview of information systems. This in turn raises questions such as 1) are there any general principles that these applications of technology have in common and can we derive such general principles in a way that they can be used to build more effective systems of those kinds? It is probably a good idea not to get too far ahead of ourselves here and proceed cautiously to the next step in this philosophical inquiry which is to answer the next question – What is an Information System?

## **Conclusion**

By pulling back from Claude Shannon's definition of information, which was rather tightly focused on reliable transmission, and redefining information as anything that helps form our internal conceptual models of reality, we provide a new perspective on information which may serve as a better foundation for understanding information systems and making some progress on the Philosophy of Information Systems.

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