Paper: How Information First Became a Thing: Early Developments in the United States and Soviet Union

Abstract: Until about 1950 usage of the word “information” was inextricably connected with the act of communication. Yet today we are used to thinking of what Michael Buckland called “information as thing.” The paper explores the process by which information was first conceptualized as a thing, which we argue took place among American computer engineers in the early 1950s. The Soviet Union provides a contrasting case, in which a more active, cybernetic concept of information remained dominant within computing culture.

Résumé:

1: Research Topic & Argument

Until about 1950 usage of the word “information” was inextricably connected with the act of communication. Information was the thing that happened when someone was informed of something. Yet today we are used to thinking of what Michael Buckland famously called “information as thing” (Buckland 1991) in contrast to older conceptions of information as knowledge or as process. Anything stored digitally using computer technology is referred to as information, whether or not it is actually informing anyone of anything. Efforts are even made (Lyman and Varian 2000) to estimate the volume of information in the world in terms of the number of terabytes of unique digital content held globally .

The paper explores the process by which information was first conceptualized as a thing, which we argue took place among computer engineers in the early 1950s. Claude Shannon’s role in creating a mathematical theory of information (Shannon and Weaver 1949) is well known. Yet Shannon’s conceptualization of information remained inextricably connected to the process of communication. An encoded message was sent from a transmitter to a receiver. His contribution was to strip the process of digital communication down to its conceptual essentials, creating a foundation for work on coding schemes, error correction, and data compression.

Shannon’s work was cited in a number of fields, and taken up along with a cluster of related ideas in the briefly fashionable metadiscipline of cybernetics (Wiener 1948). Often its appeal was metaphorical. Yet for digital communications engineers it was of great and pragmatic use. The most complex digital communication systems were early computers. Digital signals flowed constantly within the machines themselves: tape drives sent messages to controller units, memory banks channeled information into accumulators within the central processor, and output was relayed to printers and card punches. Machines, in other words, were informing each other without human intervention. It took only a small and natural act of linguistic evolution to begin to call the thing stored in a punched card, tape or memory unit “information” whether or not it was being transmitted at the time.

We track the emergency early spread of this concept of information as a thing within the community of computing pioneers during the 1950s. Fitting the conference theme of "information in a global world" we trace the process in two of the first three nations to develop digital electronic computers: the United States and the Soviet Union. Within the United States use of terms such as "information storage" was common by the early 1950s in the proceedings of the meetings of the Association for Computing Machinery and the Joint AIEE-IRE Computer Conference. This community also included some individuals such as Calvin Moores known as pioneers in information science and information retrieval, concepts that gained currency later in the decade. Discussion of cybernetics was rare.

Investigation of the Soviet story is at an earlier stage, so conclusions there are more tentative at this point with more work to be done before the paper is finalized. However this presents an interesting contrast because the application of computers in the Soviet Union was far more tightly bound up with the concepts and language of cybernetics (Gerovitch 2002), and hence the computer was conceptualized most often a node within a broader system of control and communication. Although condemned by Stalin, cybernetics was entrenched within Soviet ideology during the 1960s, enshrining this process-oriented view of information. Despite widespread efforts e.g. (Glushkov 1966; Zhukov 1971; Ursul 2010) to define information as a material quantity compatible with the Marxist-Leninist doctrine of dialectical materialism Soviet discussion of information in computing circles continued to view it as an active process rather than a static quantity.

2: Methods & Sources

This is historical work, and so our methodology is historical – a range of source materials is read, interpreted, and placed in the context of a narrative framed by questions from the existing information history literature. We are also drawing on concepts from the field of Science & Technology Studies (Hackett et al. 2007), including the social construction of scientific knowledge and the coevolution of technical concepts with expert communities. Evidence on developments in the United States is taken from the primary sources of the period. For the first half of the 1950s the most important sources are the conference proceedings and other publications of interest groups within the engineering societies and the Association for Computing Machinery. These are now incorporated into the digital libraries of the ACM and IEEE Computer Society, making searching for discussion of information much easier than previously.

For the Soviet case we are relying on primary sources in Soviet journals and books devoted to computing, cybernetics and philosophy and on existing secondary sources in the Russian language historical literature on the history of computing, only a small part of which has been translated (Malinovsky and Fitzpatrick 2010). Slava Gerovitch's book "From Newspeak to Cyber Speak" (Gerovitch 2002) is particularly useful as a guide to this material. We will also build on existing transnational comparisons found in (Mindell, Segal, and Gerovitch 2003), an on a contemporary Western attempt to describe Soviet concepts of information (Belkin 1975).

3: Context & Contribution to the Literature

The historical and conceptual aspects of information have recently attracted attention in popular attention (Gleick 2011) as well as scholarly analysis (Chandler and Cortada 2000; Hahn and Buckland 1998; Yates 2005). This historical scrutiny reflects a modern

world in which the discourse of information is rampant. An *information revolution* has putatively produced an *information society*, in which information has allegedly replaced engine as the currency of global progress in the *information age*. Universities have created schools of *informatics*, *information science*, and *information studies*, and offer degrees in *information systems* and *information management.* Businesses employ millions of *information systems specialists* and *information technologists*, reporting to *chief information officers*. Yet the word "information" takes on a quite different meaning in each of these contexts, and for each of these different communities. Almost fifty years ago, an early critic noted that information was "no more than a linguistic convenience that saves you the trouble of thinking what you are talking about." (Fairthorne 1965). The spectacular success of the word "information" in so many different areas is best explained by what, to borrow a concept from sociologist of technology Wiebe Bijker (Bijker, Hughes, and Pinch 1987), we might term its *interpretative flexibility*. Other, more precisely informative, terms could be substituted for phrases such as *information literacy* or *information system specialist* but the appeal of these phrases lies not in their precision but in their ability to invoke the broader discourse of information and so tie one's ideas to matters of universal import.

This information discourse is, historically speaking, quite recent. It developed in the decades immediately after the Second World War around computers and digital communication technologies (Kline 2006; Geoghegan 2008). Yet existing historical work has tended to take present day concepts of information for granted, projecting them back onto earlier periods such at the eighteenth century (Headrick 2000) or ancient Sumeria (Hobart and Schiffman 1998). To challenge popular accounts of a recent and unprecedented information revolution they have generally done so by applying modern concepts of information to earlier technologies such as encyclopedia, the telegraph or the US postal service. While valuable, these arguments for historical continuity have unintentionally essentialized and universalized modern concepts of information, erasing the actual social and cultural work done to construct them.

Rather than seek a true and timeless definition of information, or a single universal history of information, we need to develop multiple intertwined social and intellectual histories of the introduction, meaning and use of information concepts by particular social groups such as business managers, librarians, computer specialists, economists, physicists, and journalists. We have already begun to explore terms such as "information systems" (Haigh 2001b) and data processing (Haigh 2001a) to determine who first used them, what they were applied to, how their usage changed over time, and what cultural work they performed for communities in which they were adopted.

Cybernetics has been studied widely by historians and philosophers of science in recent years (Pickering 2002; Aumann 2011; Kline 2011). However the concept of information has generally been secondary in these accounts or confined to Shannon's conception of information as a communication process. While this work is relevant it does not answer our central question: how, where, and why did information first become a thing?

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