Zarządzanie Biblioteką Nr 1/2013

Karen R. Diller
Washington State University Vancouver
diller@vancouver.wsu.edu
LeGrand Noel Olsen
Washington State University Vancouver
LeGrand@tigard-or.gov

The Development of Information Transfer Theory: Revolution or Evolution?

(Rozwój teorii transferu informacji: rewolucja czy ewolucja?)

Słowa kluczowe: teoria informacji, transfer informacji, informacja naukowa
Abstrakt: Artykuł skupia się na teorii przepływu informacji. Przeprowadzenie analizy miało służyć adaptacji nauk o informacji i bibliotekoznawstwa do technologii Web 2.0, w taki sposób, by umożliwić sprostanie wyzwaniom XXI w.

Keywords: information theory, information transfer, science information
Abstract: The article focuses on the information transfer theory. By analysis of that theory, LIS could adapt to a post-Web 2.0 technologies, in such a way that will allow it to meet the challenges of the XXI century.

Introduction

In 1982 Landau et al. noted that "information transfer […] is concerned not only with the transmission of ideas, but also with the impact of these ideas on the users" [28, s. 82-83]. As such, information transfer is at the heart of what librarians and information scientists do. In fact, as scholars have wrestled with defining the discipline of information science, they include information transfer (or information chain) as a foundational component of the discipline. However, Robinson [38] noted that basing an understanding of the discipline of information science on the information chain, as currently defined, is problematic because it (information chain) is no longer relevant and is too restrictive. Why then is there a lack of articles about information transfer in the current Library and Information Science (LIS) literature? Comparatively few articles have been written on this topic since Duff's [15] 1997 article summarizing eight different transfer models in the literature. The few articles that have been written, like articles by Reddy [37] and Khosrowjerdi & Alidousti [24], have tended to focus on very specific subsets of users and/or information types. Both articles propose information transfer models that respond to some of the changes in agricultural and scientific communications but both are still steeped in many of the old conceptions of information, documents, and the transfer process. Is this dearth of articles due to

a perception that information transfer is no longer critical or to new vocabulary being used? One might argue that work being done on "information exchange" and "social network analysis" may be the *new* information transfer. And, when those articles are examined, one finds that they do touch on information transfer but, for the most part, they rely on an information transfer model not very different from other, older transfer models. One might also see the work on "scholarly communications" as the *new* information transfer. But, like the article entitled "Scientific Information Transfer" by Khosrowjerdi & Alidousti [24], these works only deal with the transfer of research-based information amongst experts. Even as Robinson [38] wrestled with a new definition of information science using a three-level model in which the information chain was level one, he relies on a chain that is still defined by the traditional six, distinct components of creation, dissemination, organization, indexing, storage and use.

In this paper, we argued that it is critical to refocus on information transfer theory in order for LIS to adapt to a post-Web 2.0 world in a way that will allow it to meet the challenges of the twenty-first century. In Calhoun's [7] article about the changing roles of librarians, she notes two examples of how an organization or industry can put itself out of business by not focusing on the right questions in times of change. First she notes the term "marketing myopia" which describes a view in business that "focuses on the products and services […] rather than the needs those products and services […] address". Secondly, she mentions the decline of the American railroads that was, in part, due to owners who defined their business in terms of railroads rather than in terms of transportation [7, s. 181-182]. By reconceptualizing what information transfer is, LIS researchers and practitioners will be able to concentrate on the important question of how libraries and librarians can best support knowledge creation and management, student learning, research, and everyday life.

Robinson [39] shows how tools and practices within LIS are developed and shaped from current theory. Therefore it is critical that the theoretical basis of these tools and practices accurately reflects the everyday life, paradigms and world-views of the current and near future world so that the tools and practices, themselves, will be relevant and useful. For example, in applying this to one tool, Davies et al. notes how the "incremental and modest improvements to relevance ranking" [12, s. 66] that search engine designers are making are insufficient because they are making improvements to a searching paradigm that is outdated. What is needed is a new paradigm that supports the information management process that is developing in response to the capabilities of new technologies.

We will argue that information transfer theory does not just need to be revised but that it is currently in a state of crisis that is leading to a much-needed revolution in the theory. Kuhn [27], in his *Structure of Scientific Revolutions*, provides a framework in which to consider this revolution. The steps that Kuhn lays out for scientific revolutions are as follows:

1. existing paradigm;
2. normal science;
3. anomalies;

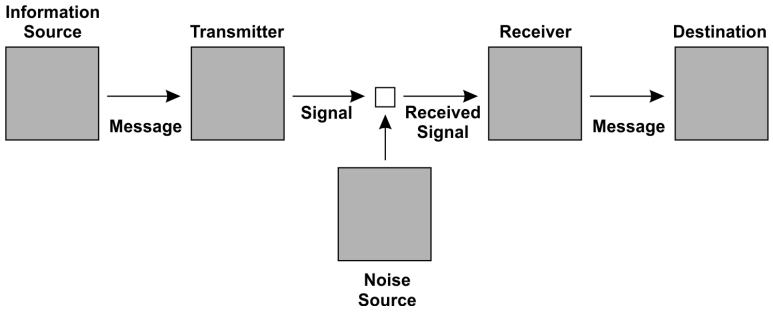
4. crisis;
5. revolution;
6. new paradigm.

Basically, Kuhn states that scientific research progresses using the existing paradigm until too many anomalies, which can not be explained by the existing paradigm, become known. The existence of these anomalies then creates a crisis in which a new paradigm must be adopted, thus the revolution. We will show how Web 2.0+ technologies, new conceptualizations of information and documents, and the socio-cultural move to post-structuralism have created enough anomalies within existing information transfer models that information transfer, as a field of study, is in crisis and needs to be reconstructed "from new fundamentals, a reconstruction that changes some of the field's most elementary theoretical generalizations" [27, s. 85]. In addition, we will propose a new information transfer model that solves for the anomalies found in older models.

Traditional Model

First, we need to consider what made up the "existing paradigm" stage of information transfer theory. LIS literature considers this to be the traditional model of information transfer and it is a model based on Weaver's 1949 definition of information. Weaver states that the idea of "information" is "an information source which is producing a message by successively selecting discrete symbols (letters, words, musical notes, spots of a certain size, etc.)" [44, s. 102]. Information is seen as "messages [that] are organized exchanges (e.g. grammatical sentences) based on *selections* from an agreed-upon set of signals (phonemes, words, letters, etc)" [8, s. 46]. In a text introducing the library and information professions, Greer, Grover and Fowler [18] present what can be called the traditional model of information transfer which is based on the Shannon and Weaver model discussed earlier and seen in figure 1 below. This model, in McCreadie's and Rice's [31] words sees information as a resource or commodity which is passed from sender to receiver.

Figure 1. Shannon and Weaver Diagram

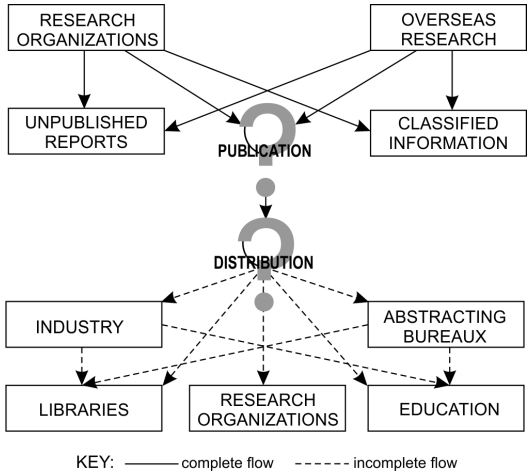


Source: SHANNON Claude Elwood, WEAVER Warren. *The mathematical theory of communication*. Urbana, 1949, s. 5.

Other models that fit into this paradigm are the first two models described by Duff (see figures 2 & 3.), Urquhart's 1948 model and Judge's 1967 model [15; 46; 23]. As Duff himself points out when speaking about Urquhart's model, these traditional models are "orderly and hierarchical" [15, s. 180] and have been produced by experts in the field, speaking to other researchers. All three models assume a unidirectional flow of information from creator to user with intermediaries that collect and distribute the information itself or an abstracted version of the information. These models are based on the assumptions that "experts" will either know to whom to tranfer the information or will provide the information to users who know whom (and maybe even how) to ask. It is interesting to note the question marks in the middle of Urquhart's model. These represent bottlenecks in the information chain. Both bottlenecks are system-centered, one dealing with the lack of publication of some information and the other dealing with the lack of a single, methodical distribution process [46].

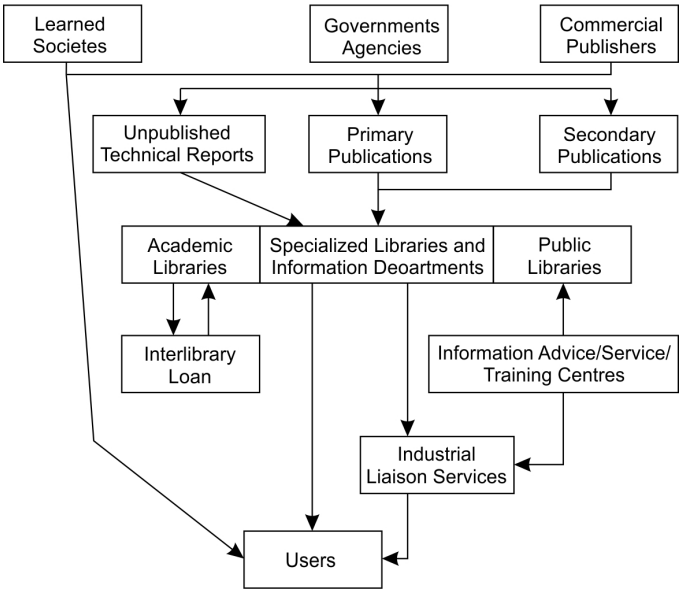
Another way to represent the traditional model of information transfer is through the six components that Achleitner [1] points out are the standard components describing information transfer: creation; dissemination; organization; indexing; storage; and, use. The characteristics of the traditional model, as set forth here can be thought of as the theory that defines the "existing paradigm" stage in Kuhnian terms.

Figure 2. Duff's simplification of Urquhart's Model



Source: URQUHART D. J. *The organization of the distribution of scientific and technical information. In The Royal Society Scientific Information Conference 21 June-2 July 1948: report and papers submitted.* London, 1948, s. 526.

Figure 3. Judge's Model



Source: JUDGE P. J. User-system interface today: National and international information systems. In DEREUCK A., KNIGHT J. (red.). Communication in Science: Documentation and Automation. Boston, 1967, s. 44; DUFF A. S. Some post-war models of the information chain. Journal of Librarianship and Information Science. 1997, No. 4, s. 180.

Anomalies

What are the changes in society and technology that are causing anomalies which cannot be explained or handled by the current information transfer models? These anomalies fall into three categories: sociological movements; definitions of information and documents; and technology.

Sociological Movements.

Because the development of theory in any one discipline is influenced by broader socio-cultural movements, it is important at this time to look at two major sociological theories which have existed in Western society in the twentieth and twenty-first centuries, structuralism and poststructuralism. As we consider the development of information transfer models, we will consider how their development fits within these broader social theories. Structuralism, as it developed during the mid-twentieth century, posits that "cultural activity can be approached and analyzed objectively as a science" [22, s. 665] and that solutions to issues are found by understanding the underlying structure of those issues. In fact, structuralists would argue that, once the structure is understood, all can be explained within that structure. The human, in this picture, is "seen as being impelled, if not determined, by structures"

[41, s. 804]. Because of the importance of binary oppositions and the favoring of one over the other within these oppositions, structuralism also sees structure in terms of hierarchy [3; 32].

Poststructuralism started with the critiques of structuralism in the mid- to late-twentieth century and rejects rigid and over-reaching generalizations, absolute meanings, and "monolithic structure" [35]. In its application to literary theory, it decentralizes both an absolute subject and the author in favor of the meaning found by individual readers [3].

Schwartz and Ogilvy [42], in their 1979 discussion of a major change in paradigms used for "humanity's image of reality and self", define two paradigms, the dominant and the emergent. In their definitions, it is easy to see the change from structuralism to poststructuralism. The societal qualities that they describe as being part of the dominant or emergent paradigms very much describe the movement from structuralism to poststructuralism (see figure 4). This change in world view, as viewed through the lens of structuralism and poststructuralism or through the Schwartz/Ogilvy lens, creates anomalies for the traditional model of information transfer. Rather than assuming that a perfect hierarchical structure can be found to transfer information from creator to user, a poststructuralist paradigm requires a more complex, socially-influenced, user-centered paradigm.

Figure 4. Adapted from Schwartz & Ogilvy

Dominant Paradigm	Emergent Paradigm
From:	Toward:
Simple/probabilistic	Complex and diverse
Hierarchy	Heterarchy
Mechanical	Holographic
Determinate	Indeterminate
Linearly causal	Mutually causal
Assembly	Morphogenesis
Objective	Perspective

Source: SCHWARTZ Peter, OGILVY James A. *The emergent paradigm: changing patterns of thought and belief*. Menlo Park, CA, 1979, s. 13.

Certainly influenced by the move from structuralism to poststructuralism is the change in how society looks at authority. Nicholson, in an address entitled "The Changing Nature of Intellectual Authority", notes how the rise of the individual and the "widespread 'decline of deference' to virtually all forms of traditional authority" combined with the overwhelming growth of instant media and information production are changing the structures for determining intellectual authority [33, par. 10]. No longer

are the cultural hierarchies (peer review, publishing houses, elite consensus building) being looked to for their stamp of approval. Instead it is "individuals themselves who weigh the various authorities and come to their *own* conclusion" [33, par. 16]. This is in direct contrast to the traditional model that relies on a hierarchy of authority.

Definitions of Information and Documents

In 1999, McCreadie and Rice reviewed the professional information science and communication literature in order to find what conceptualizations of "access to information" were present in these disciplines [31]. As part of this effort, the authors found four conceptualizations of information (see figure 5). These conceptualizations prove to be especially applicable to an investigation of information transfer models because current models do not allow for all four conceptualizations of information that are currently present in the literature. The traditional information transfer model conceptualizes information as a "resource/commodity" or as "representation of knowledge" but it is unable to handle the "data in environment" and "part of process" conceptualizations that McCreadie and Rice found in the LIS literature [31].

Figure 5. Conceptualizations of Information

Conceptualization	Description	Assumptions
Resource Commodity	A message, a commodity, something that can be produced, purchased, replicated, distributed, sold, traded, manipulated, passed along, controlled	Assumes sender → receiver; assumes receiver makes of message what sender intends
Data in environment	Objects, artifacts, sounds, smells, events, visual and tactile phenomena, activities, phenomena of nature	Accounts for unintentional communication
Representation of knowledge	Documents, books, periodicals, some visual and auditory representations; abstractions of information (e.g. citations)	Assumes printed document is primary representation of knowledge; assumes primacy of scientific technical knowledge
Part of process of communication	Part of human behavior in process of moving through time/space to make sense of world	Assumes meanings are in people, not in words; assumes human behavior is basis of understanding the process

Source: MCCREADIE Maureen, RICE Ronald E. Trends in analyzing access to information. Part I: cross-disciplinary conceptualizations of access. *Information Processing & Management*. 1999, No. 1, s. 47.

As technology has developed, the definition of what a document is has also expanded. The variety of formats of digitally born objects continues to grow and this variety is already presenting unique challenges especially in relationship to long-term preservation and use. As Owen puts it "The digital library is based on information objects that could have any type of (often dynamic and distributed) formats" [34, s. 280]. These formats may include such items as raw data, software and conversations as well as more traditionally-formatted documents. In addition, there have been strong arguments for expanding the definition of "document" to include such things as archaeological finds, works of art, educational games and more. (For a thorough discussion of this, see Buckland [6]). Finally, technological developments have allowed and perhaps even encouraged the separation of whole documents into discrete parts that may never be united into a single entity for the user. Thus, the traditional model's assumption that the information to be transferred is in a single, discrete unit is no longer an assumption that holds.

Technology

The nature and design of Web 2.0 technologies such as blogs, wikis, social media sites, and digital libraries, have brought about the largest anomalies in information transfer theory. These technological applications are reshaping and transforming our perception and understanding of the very nature and form of information, documents, and transfer. While there are numerous anomalies that have evolved from the rapid evolution of technologies, it is sufficient here to discuss three anomalies that impact key components of the traditional information transfer model.

One of the major anomalies brought on by technology is the disintegration of clear lines between the roles and functions that are so clearly delineated in the traditional model [34]. No longer are authors only authors, aggregators only aggregators and users only users. Web 2.0+ technologies allow for the co-creation of information where co-creators may be both expert and novice, both creator and user. Institutional repositories and personal servers allow for creators to also be disseminators and the emphasis on making information available on the Web allows for disintermediation where users and creators can directly interact without any intermediaries. Combine this with the cultural shift towards distrust of hierarchies and a decline in deference to authority [33] and one is in the position where the end user is weighing the evidence directly and drawing his or her own conclusions about the authority of information, without the help of intermediaries.

Another anomaly brought on by technology and related to the blurring of lines between functions and roles is the lack of unified organization and indexing authorities. Each application or site can organize and index content for their own needs and their own users with little or no uniformity even when organizing and indexing the same information. In addition, new technologies allow for users to participate in indexing through user-generated tags [12] and the semantic web and catalog implementation of FRBR (Functional Requirements for Bibliographic Records) are adding new dimensions

to indexing that rely more on the relationships between items indexed and the size of the known electronic "footprint" of that information.

Other applications cause anomalies with the traditional transfer model. It is now possible for the details of how information is accessed and used to be collected in ways that are not only influencing decisions about the best way to make information available but also determining whether or not that information will be made available at all in the future [2]. The traditional end of the transfer process is now actually influencing the entire transfer process in a way unimaginable through the traditional model.

Normal Science

Just as Kuhn's model suggests, information professionals have tried to adapt information transfer models during what he would call the "normal science" stage. These adaptations have been in response to some of the anomalies discussed here but they have been unsuccessful, thus far, in answering all of the anomalies. To illustrate how the new information transfer models have been adapted to answer some of the anomalies not covered by the traditional model, we will briefly look at three examples: four D's model, diffusion, and social network analysis and information exchange.

Four D's

As mentioned before, Reddy [37] developed a model of information transfer for agricultural information. His model developed out of an interest in seeing how the proliferation of digital information sources and the technologies behind them had impacted agricultural information transfer. Reddy's "Four D's" model does acknowledge the two-way flow of information and that scientists are both authors and end-users. However his model emphasizes that technology's major impact on transfer is one of making the traditional transfer faster and easier, not causing the entire transfer process to be reconceptualized. His model also still emphasizes the roles of intermediaries both in distribution and quality control. Finally, the model does recognize the two-way flow of information but does not allow for the co-creation of information.

Diffusion

Perhaps the most well-developed transfer theory is that of diffusion, first developed by Rogers in 1962. In his own words, diffusion "is the process in which an innovation is communicated through certain channels over time among the members of a social system" [40, s. 5]. As the theory has been developed since Rogers first proposed it, one can see researchers working within the theory to further define and refine it. One of the first refinements was to expand the theory to cover the transfer of information to and throughout practitioner groups rather than the transference of information solely within research and scholarly communities. A very early example of this can be seen in Hoffer's [21] paper on applying the diffusion model to practitioners in the social welfare field. More recent work takes this further by applying diffusion theory to the flow of everyday life information amongst the socio-economic poor [9]. Both examples

illustrate a broadening of the definitions of what content and what structures can be included in information transfer models.

At the same time as these more structuralist approaches within diffusion theory were being developed, the theory was also evolving to include other conceptualizations of information and poststructuralist thought. In 1982 Landau et al. were looking for an information transfer model that went beyond what they described as one that is only concerned with "the delivery of an information package" [28, s. 82]. They decided to use the diffusion model because it acknowledged that the information package should be related to the user's information need.

Three additional themes in diffusion research, willingness to innovate, champions, and contagion/emulation, are all examples of how diffusion research has further expanded and refined information transfer models and has incorporated the other two McCreadie and Rice conceptualizations of information into the theory. Definitions of information as "data in the environment" or "unintentional communication" and as "a process of communication" can all be found in these three themes.

Willingness to Innovate

A 1996 literature review on innovation and organizations points out that the literature in this area falls into two distinct groups, research that found context very influential and research that found community and the traits of the individuals involved very influential [14]. Chaves' [10] work on the diffusion of the ordination of women also examined factors that influence the adoption of innovation. He found that political and institutional pressures, cultural norms within the denomination, network connections, and the characteristics of the internal organization all impact the willingness to innovate.

Champions

The definition and role of champions within DIM has been acknowledged by Rogers [40] himself. He points out that champions are often those "particularly adept at handling people, an individual skillful in persuasion and negotiation" [40, s. 415]. Further research shows that champions are frequently those in middle management who have strong communication skills and who understand the individual aspirations of those within the organization, thus acknowledging the importance of the individual and of the social context within the transfer process [17].

Contagion/Emulation

Contagion, defined as diffusion without the initiator or receiver being aware of the spread, and emulation, defined as diffusion with only the receiver being aware [13] not only acknowledges the social context as being very influential in DIM but also shows the impact of unintended communication, two of the McCreadie and Rice conceptualizations.

Social Network Analysis and Information Exchange

In Dearing's 2006 comments on diffusion, the contribution of social network analysis on diffusion studies can be seen. He comments that we learn of innovations through impersonal means "but only decide to adopt an innovation for ourselves later, after asking the opinion or observing the behavior of someone whom we know, trust, or consider to be expert" [13, s. 175]. One of the methods applied to studying information transfer beginning in the 1990's is Social Network Analysis (SNA) which is a method developed to study the exchange of items, ideas or resources among either individuals or groups/organizations (see [43]). Haythornthwaite [19] is an early proponent in the library science literature of using Social Network Analysis (SNA) to study information exchange although this idea of social networks and information transfer can be traced at least as far back as Cronin's [11] 1982 work on invisible colleges.

On first look, applying SNA to information transfer may not seem like a step forward. This method assumes an underlying structure and assumes that an understanding of this structure can provide useful information to the solution of transfer problems. However, there are important differences. First is the understanding that one type of content being passed between members of a network could be "collaborative writing" [19, s. 326] which implies more than a sender-receiver relationship. And, second, is the understanding that social network structures are not universal but individualistic. Haythornthwaite [19] points out that differences may arise from a variety of sources such as nationality or gender and Hersberger [20] notes that earlier SNA studies do not consider the overall environment or details about the population being studied and, therefore, are of limited use.

Articles on using SNA to study information transfer tend to use the phrase "information exchange" and, in fact, many articles written in the early twenty-first century use an information exchange model to describe information transfer. However, when considering definitions of information like McCreadie's and Rice's, one can quickly see why the information exchange model differs little from diffusion. Remember that their definitions of information include the importance of socially-constructed information. When scanning the exchange literature, one does see an emphasis on information, as a resource/commodity, flowing in more than one direction, thereby overcoming the more traditional, hierarchical model (e.g. [20; 36]). However, there is very little, if any, mention made of how both the sender and receiver may interact with the message to construct something new. The closest that the exchange literature gets is the aforementioned "collaborative writing" by Hersberger [20] and the brief mention by Kramer & Cole of how "interactive positive relationship building" [25, s. 56] impacts the transfer of knowledge in the workplace.

Kuhn and the Current State of Information Transfer

At this moment in time, information transfer theory may best be described as being in Kuhn's stage four, that of crisis. In examining the development of information transfer theory, it has been shown that researchers are recognizing the anomalies

and problems of current models. Organizational theorists have recognized the inability for a unifying structure to predict whether, when or how an organization will adopt a particular innovation; information scientists have noted how SNA studies frequently leave out social, cultural and individual details which limit the understanding of the full transfer picture; and, the medical field has documented the problems inherent in an exchange model which does not fully realize two-way dialogue and information construction and which privileges expert one-way flow over lay and interactive information flow (e.g. [29]).

Perhaps the most important anomaly that is bringing information transfer theory to a crisis is the growing importance of the "data in environment" and the "process of communication" conceptualizations of information and the rise of a new conceptualization of information. With the rise of Web 2.0 technologies, the 24-hour news cycle, and the, some would say, over abundance of data, not only does information transfer theory need to incorporate all four of McCreadie's and Rice's conceptualizations of information but it also needs to incorporate a new conceptualization, that of "collective intelligence". Bothos, et al. [5] takes Malone's and Klein's [30, s. 15-16] definition of collective intelligence, "the synergistic and cumulative channeling of the vast human and technical resources now available over the internet", and adds "to enable emergent knowledge" [5, s. 27] to make up their definition of collective intelligence. As such, this is a fifth conceptualization of information, one not found within the four set forth by McCreadie and Rice. The growing importance of this conceptualization of information can be seen in discussions of information transfer and exchange in such widely disparate areas as how airlines and consumers can benefit from information distributed via passenger tweets [45], how to create systems to support collective intelligence in virtual stock markets [5], and how to evaluate e-government portals [16].

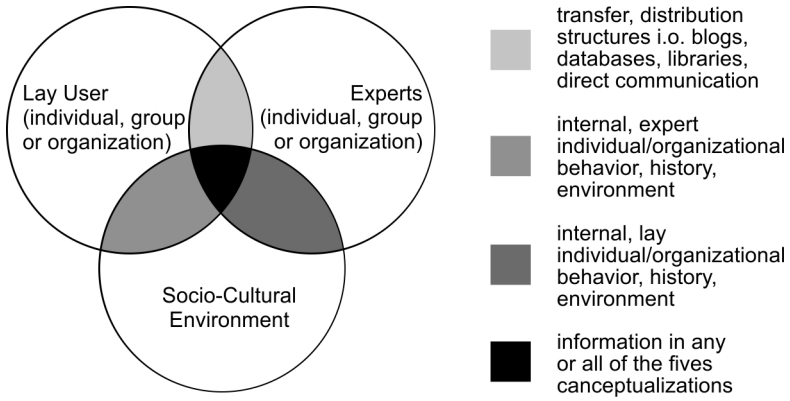
Other research has also hinted at the need for a new conceptualization of information. As far back as 1996, Berman [4], in his study of internet-based social work discussion groups and information transfer, noted that one use of discussion groups was for a small group of individuals to construct new knowledge among themselves. More recently, Kuhlen [26] has noted the more collaborative nature of information transfer and exchange as he posited a changing paradigm in knowledge management. He notes that "information is not just the result of a particular distribution or retrieval process […] but is also the result of communication processes" [26, s. 2]. He goes on to note that knowledge and information is not static and discrete but is a "continual process of exchange and communication" [26, s. 3] Van Dijck [47], in his thought-provoking article "After the Two Cultures", would agree with Kuhlen's assessment. In his survey of more recent developments in journalism, medicine, and science, Van Dijck suggests new roles for traditional players in the information transfer model. He calls the media "actors" in the construction and dissemination of information and calls patients "coconstructors" of knowledge.

New Model

If information transfer theory is at the point of crisis, what will the revolution look like? A new information transfer model, to be a comprehensive theory, must be able to accommodate all four conceptualizations of information as described by McCreadie and Rice and a fifth conceptualization of information as "collective intelligence". It must also recognize that individual and socio-cultural concepts play a role in what, how, where, and when transfer takes place. In addition, this model must recognize that transfer may be a one or two way street, needs to include active two-way participation in the creation of information and that the value or authority of the information is not necessarily determined by the status of the sender.

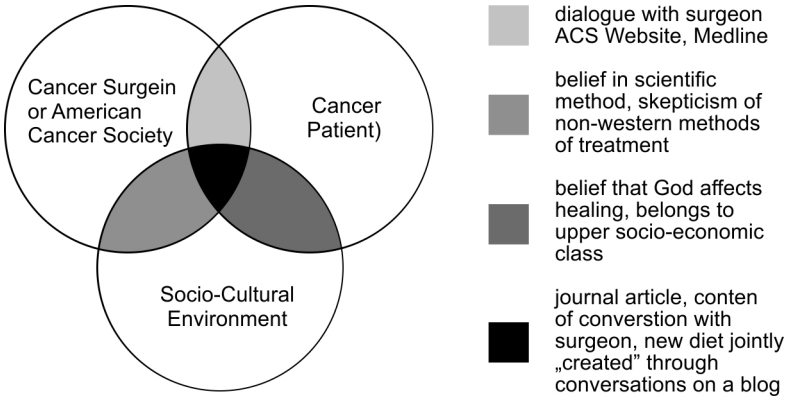
Can a single model be that comprehensive? A poststructuralist would say no and this author would agree. In order for the theory of information transfer to be applicable today it must throw out the idea of a single linear model that emphasizes structures of distribution and develop a template approach. This template would recognize all of the important roles within a transfer process but, being a template instead of a model, it would recognize that specifics within the template change based on the situation. A new template could look like figure 8. Important to note in this template is that the expert and the lay user are on equal footing, that the information included in this model could be any or all of the five conceptualizations of information, and that the distribution structures have been de-emphasized. This template is not seen as a monolithic structure to describe all transfer processes but, rather, a template representing important "player types" in the transfer process which then are defined based on a specific situation. For example, this template may be transformed into figure 9 when looking at the transfer process surrounding a cancer patient's information journey.

Figure 8. Information Transfer Template



Source: self-elaboration.

Figure 9. Information Transfer Template - Cancer Patient



Source: self-elaboration.

Conclusion

The Kuhnian model of scientific revolutions, while developed to apply only to scientific progress, is applicable to the development of information transfer theory. While the traditional paradigm of information transfer was the "existing paradigm", it has undergone refinements during what Kuhn would call the "normal science" stage. However, in a poststructuralist world, with the development of radically new technologies, major anomalies have been discovered which is forcing a crisis in information transfer theory, a crisis that only a revolution can solve.

Theory and models are important to the practice of library and information science. In order to develop tools and services that are relevant and useful in a world that has been turned upside down by rapidly changing technologies and new world views, it is essential for LIS professionals to lead this revolution. Recent models have further developed the traditional transfer model but have not been able to incorporate the anomalies that currently exist. By not incorporating these anomalies into an expanded and more flexible model of information transfer, the profession could be risking the same decline that the railroads experienced when they defined their business only in terms of railroads rather than transportation.

References

1. ACHLEITNER Herbert K. Information transfer, technology, and the new information professional. In PITKIN Gary M. (red.). *Impact of emerging technologies on reference service and bibliographic instruction*. London: Greenwood Press, 1995, s. 137-149. ISBN 978-03-13-29365-8.
2. ALTER Alexandra. Your e-book is reading you. *Wall Street Journal*. 2012, s. 1-D1. ISSN 0099-9660.
3. BELSEY Catherine. *Poststructuralism, a very short introduction*. New York: Oxford University Press, 2002. ISBN 01-92801-80-5.

4. BERMAN Yitzhak. Discussion groups on the Internet as sources of information: The case of social work. *Aslib Proceedings*. 1996, No. 2, s. 31-36. ISSN 001-253X.
5. BOTHOS Efthimios, APOSTOLOU Dimitris, MENTZAS Gregoris. Collective intelligence for idea management with Internet-based information aggregation markets*. Internet Research*. 2009, No. 1, s. 26-41. ISSN 1066-2243.
6. BUCKLAND Michael K. What is a "document"? *Journal of the American Society of Information Science.* 1997, No. 9, s. 804-809. ISSN 0002-8231.
7. CALHOUN Karen. Being a librarian: metadata and metadata specialists in the twenty-first century. *Library Hi Tech*. 2007, No. 2, s. 174-187. ISSN 0737-8831.
8. CASE Donald O. *Looking for information: A survey of research on information seeking, needs, and behavior.* Wyd. 2. Bingley, U.K.: Emerald, 2008. ISBN 978-01-23-69430-0.
9. CHATMAN Elfreda A. Diffusion theory: A review and test of a conceptual model in information diffusion*. Journal of the American Society for Information Science*. 1986, No. 6, s. 377-386. ISSN 0002-8231.
10. CHAVES Mark. Ordaining women: The diffusion of an organizational innovation. *American Journal of Sociology*. 1996, No. 4, s. 840-873. ISSN 0002-9602.
11. CRONIN Blaise. Invisible colleges and information transfer: A review and commentary with particular reference to the social sciences. *Journal of Documentation*. 1982, No. 3, s. 212-236. ISSN 0022-0418.
12. DAVIES John, DUKE Alistair, KINGS Nick, MLADENIC Dunja, BONTCHEVA Kalina, GRCAR Miha, BENJAMINS Richard, CONTRERAS Jesus, CIVICO Mercedes Blazquez, GLOVER Tim. Next generation knowledge access. *Journal of Knowledge Management*. 2005, No. 5, s. 64-84. ISSN 1367-3270.
13. DEARING James W. Communication as diffusion. In SHEPHERD Gregory J., ST. JOHN Jeffrey, STRIPHAS Ted. (red.). *Communication as…: Perspectives on theory*. London: Sage, 2006, s. 174-179. ISBN 978-14-12-90658-6.
14. DRAZIN Robert, SCHOONHOVEN Claudia Bird. Community, population, and organization effects on multilevel perspective*. Academy of Management Journal*. 1996, No. 5, s. 1065-1083. ISSN 0001-4273.
15. DUFF Alistair S. Some post-war models of the information chain. *Journal of Librarianship and Information Science*. 1997, No. 4, s. 179-187. ISSN 0961-0006.
16. GOH Dion Hoe-Lian, CHUA Alton Yeow-Kuan, LUYT Brendan, LEE Chei Sian. Knowledge access, creation and transfer in e-government portals. *Online Information Review*. 2008, No. 3, s. 348-369. ISSN 1468-4527.
17. GOODMAN Robert M., STECKLER Allen. A model for the institutionalization of health promotion programs*. Family and Community Health*. 1989, No. 4, s. 63-78. ISSN 0160-6379.
18. GREER Roger C., GROVER Robert, FOWLER Susan G. *Introduction to the library and information professions.* Westport, Conn.: Libraries Unlimited, 2007. ISBN 978-15-91-58486-5.
19. HAYTHORNTHWAITE Caroline. Social network analysis: An approach and technique for the study of information exchange*. Library and Information Science Research*. 1996, No. 4, s. 323-342. ISSN 0740-8188.
20. HERSBERGER Julie. A qualitative approach to examining information transfer via social networks among homeless populations. *New Review of Information Behaviour Research*. 2003, No. 1, s. 95-108. ISSN 1471-6313.

21. HOFFER J. R. The communication of innovations in social welfare: The role of the specialized information centers. *Proceedings of the American Society for Information Science, Annual Meeting*. Columbus, OH: Greenwood Publishing, 1968, Vol. 5, s. 25-27.
22. INNES Paul. Structuralism. In PAYNE Michael, BARBERA Jessica Rae (red.). *A dictionary of cultural and critical theory.* Malden, MA: Wiley-Blackwell, 2010, s. 665-669. ISBN 978-14-05-16890-8.
23. JUDGE P. J. User-system interface today: National and international information systems. In DE REUCK Anthony, KNIGHT Julie (red.). *Communication in Science: Documentation and Automation.* Boston: Little, Brown, 1967, s. 37-51.
24. KHOSROWJERDI Mahmood, ALIDOUSTI Sirous. *Scientific information transfer: a conceptual model for scientific communication in IranDoc*. 2010, No. 6, s. 818-828. ISSN 0264-0473.
25. KRAMER Desre M., COLE Donald C. Sustained, intensive engagement to promote health and safety knowledge transfer to and utilization by workplaces. *Science Communication*. 2003, No. 1, s. 56-82. ISSN 1552-8545.
26. KUHLEN Ranier. *Change of paradigm in knowledge management – framework for the collaborative production and exchange of knowledge* [Dokument elektroniczny]. 2003. Tryb dostępu: http://www.kuhlen.name/publikationen.html. Stan z dnia 23.08.2012.
27. KUHN Thomas S. *The Structure of Scientific Revolutions*. Chicago: University Of Chicago Press, 1996. ISBN 978-02-26-45808-3.
28. LANDAU Herbert B., MADDOCK Jerome, SHOEMAKER F. Floyd, COSTELLO Joseph G. An information transfer model to define information users and outputs with specific application to environmental technology. *Journal of the American Society for Information Science*. 1982, No. 2, s. 82-91. ISSN 0002-8231.
29. LEE Renee Gravois, GARVIN Theresa. Moving from information transfer to information exchange in health and health care. *Social Science & Medicine*. 2003, No. 3, s. 449-464. ISSN 0277-9536.
30. MALONE Thomas W., KLEIN Mark. Harnessing collective intelligence to address global climate change. *Innovations Technology Governance Globalization.* 2007, No. 3, s. 15-26. ISSN 1558-2477.
31. MCCREADIE Maureen, RICE Ronald E. Trends in analyzing access to information. Part I: cross-disciplinary conceptualizations of access. *Information Processing & Management*. 1999, No. 1, s. 45-76. ISSN 0306-4573.
32. MURPHY James M. Poststructuralism. In REITZER George (red.). *Encyclopedia of social theory.* Thousand Oaks, CA: Sage Publications, 2005, s. 590-592. ISBN 07-61926-11-9.
33. NICHOLSON Peter J. *The changing role of intellectual authority. Notes for remarks to the Association of Research Libraries* [Dokument elektroniczny]. Tryb dostępu: http://www.arl.org/resources/pubs/mmproceedings/nicholson~print.shtml. Stan z dnia 05.09.2012.
34. OWEN John MacKenzie. The new dissemination of knowledge: Digital libraries and institutional roles in scholarly publishing. *Journal of Economic Methodology*. 2002, No. 3, s. 275-288. ISSN 1350-178X.
35. PAYNE Michael. Poststructuralism. In PAYNE Michael, BARBERA Jessica Rae (red.). *A dictionary of cultural and critical theory*. Malden, MA: Wiley-Blackwell, 2010, s. 576-577. ISBN 978-14-05-16890-8.

36. PETTIGREW Karen E. Lay information provision in community settings: How community health nurses disseminate human services information to the elderly. *Library Quarterly*. 2000, No. 1, s. 47-85. ISSN 0024-2519.
37. REDDY Deva E. Using the four Ds model of agricultural information transfer to study the impact of digital information sources. *Quarterly Bulletin of the International Association of Agricultural Information Specialists*. 2005, No. 3/4, s. 96-99. ISSN 1019-9926.
38. ROBINSON Lyn. Information science: communication chain and domain analysis. *Journal of Documentation*. 2009, No. 4, s. 578-591. ISSN 0022-0418.
39. ROBINSON Lyn, KARAMUFTUOGLU Murat. The nature of information science: changing models. *Information Research* [Dokument elektroniczny]. 2010, No. 4. Tryb dostępu: http://informationr.net/ir/15-4/colis717.html. Stan z dnia 23.08.2012.
40. ROGERS Everett M. *Diffusion of innovations*. New York: Free Press, 2003. ISBN 978-07-43-22209-9.
41. RYAN Michael. Structuralism. In RITZER George (red.). *Encyclopedia of social theory*. Thousand Oaks, CA: Sage Publications, 2005, s. 804-805. ISBN 07-61926-11-9.
42. SCHWARTZ Peter, OGILVY James A. *The emergent paradigm: changing patterns of thought and belief.* Menlo Park, CA: SRI International, 1979.
43. SCOTT John. *Social network analysis: a handbook*. Thousand Oaks, CA: Sage Publications, 2000. ISBN 978-07-61-96338-7.
44. SHANNON Claude Elwood, WEAVER Warren. *The mathematical theory of communication*. Urbana: University of Illinois Press, 1949.
45. SREENIVASAN Nirupama Dharmavaram, LEE Chei Sian, GOH Dion Hoe-Lian. Tweeting the friendly skies: Investigating information exchange among Twitter users about airlines. *Program: Electronic Library and Information Systems*. 2012, No. 1, s. 21-42. ISSN 0033-0337.
46. URQUHART D. J. The organization of the distribution of scientific and technical information. In *The Royal Society Scientific Information Conference 21 June-2 July 1948: report and papers submitted.* London: The Royal Society, 1948, s. 524-527.
47. VAN DIJCK Jose. After the "two cultures": Towards a "(multi)cultual" practice of science communication. *Science Communication*. 2003, No. 2, s. 177-190. ISSN 1075-5470.