Stodola, Jiří

The cognitive paradigm in information science with a view to sensorially impaired persons

ProInflow. 2011, vol. 3, iss. 1, pp. 123-134

ISSN 1804-2406

Jiří Stodola

THE COGNITIVE PARADIGM IN INFORMATION SCIENCE WITH A VIEW TO SENSORIALLY IMPAIRED PERSONS

(*KOGNITIVNÍ PARADIGMA V INFORMAČNÍ VĚDĚ SE ZŘETELEM K OSOBÁM SE SMYSLOVÝM POSTIŽENÍM)*

Zajímavosti z oboru

Abstrakt:

Článek obsahuje úvod do tří hlavních paradigmat informační vědy podle Rafaela Cappura a přináší argumenty, proč je důležité zvolit správné paradigma a proč by mělo být kognitivní paradigma považováno za základní. První argument je založen na filosofickém zkoumání podstaty pojmu informace, druhý spočívá v pozorování získaném výzkumem zprostředkování informací osobám se smyslovým postižením. V závěru článku je stručně představen návrh možného výzkumu.

Klíčová slova: *informační věda, paradigmata informační vědy, kognitivní paradigma, osoby se smyslovým postižením, výzkum*

Abstract:

The article provides a short introduction to the three main paradigms of information science according to Rafael Capurro and brings some argumets, why an optimal paradigm selection is important and why cognitive paradigm should be considered to be fundamental one. First argument is grounded on the philosophical inquiry into the concept of information substance, the second one is based on the observation obtained from the research into the mediation of information to users with sensorial disability. The brief design of the possible research is introducted in the final part of the article.

Keywords: *information science, paradigm of information science, cognitive paradigm, sensorially impaired persons, research*

1 Introduction. The field of information science

Information science is a discipline where the formal subject is still sought for. There exist certain different paradigms in this field, and this status results from the fact that the term "information" is applied in various human knowledge branches: it is a multidisciplinary concept. Rafael Capurro (1992), a philosopher and information science theorist, distinguishes three main paradigms in information science.

Thus, the categorization is realized in the following manner:

- the representation paradigm;
- the source-channel-receiver paradigm;
- the Platonistic paradigm.

In order to illustrate the views of this scholar, let us quote some of his own words concerning the problem. In one of his articles, Capurro says:

According to the representation paradigm human beings are knowers or observers of an outside reality. The process of knowledge consists of an assimilation of things through their representations in the mind/brain of the knowing subject. [...]

On this basis information science is concerned with the study of representation, codification and rational use of information.

The source-channel-receiver paradigm takes the phenomenon of human communication as a metaphor to be applied to different levels of reality. When they communicate, human beings, or other kinds of sources and receivers, are said to exchange information. [...]

Under these premisses information science is primarily concerned with the impact of information on the receiver. At the same time, receivers are seekers or users of information in order to solve their problems.

Finally, the Platonistic paradigm takes an opposite view to the foregoing. Instead of starting with a knowing subject, it looks for something to be considered as information in itself. This is the sphere of human knowledge not as a biological, psychological or sociological process but as objectivized in non-human carriers.[...]

Information science is supposed to study primarily the world of information in itself, i.e., to contribute to the analysis and construction of it. Information has

the same ontological status as the laws of logic with regard to the psychological or biological description of the process of thinking.[1]

As we are living in the information society (or in the society of knowledge), the dealing with any inquiry into information processes is very useful and it constitutes the main subject of information science. Hence, it is necessary to analyze the basis or structure of information science; importantly, such analysis should include the problem of an optimal paradigm selection.

There are two reasons to prioritize the cognitive paradigm in information science. The first reason is theoretical (deductive) and the second one is practical (empirical).

2 The theoretical reason (the deductive argument)

There exists a connection between the theoretical reason and the authors´s previously published research reports. In order to view this link in a rather more concrete manner, let us note that the binding element lies in the search for the solution to the so-called Capurro's trilema. As such, the trilema consists in the answering of the question of whether information is an univocal, analogical, or equivocal concept. Rafael Capurro writes: *Information may mean the same at all levels (univocity), or something similar (analogy), or something different (equivocity).*[2] In his article[3] author has found certain reasons why "information" cannot be an equivocal or a univocal concept. That conclusion stems from the author´s consideration of the concept of information (in accordance with scholars like Wiener[4] or Stonier[5] as a principle of being. Therefore, he argues for the analogical status of the information concept; as a matter of fact, the status means that the term "information" at different levels of reality signifies similar but not identical things. Then, we can use the concept as univocal and utilize it up to its actual division into categories. According to two fundamental category types, it is necessary to speak about the information which has a connection with the

1 CAPPURO, R. What is information science for? A philosophical reflection. In *Conceptions of Library and Information Science : Historical, empirical and theoretical perspectives*. London : Taylor Graham, 1992. ISBN 0-947568-52-2, pp. 82-98.

2 CAPURRO, R. Is a unified theory of information feasible*?* In HOFKIRCHNER, W., ed.: *The quest for a unified theory of information : proceedings of the Second international conference on the foundations of information science*. Amsterdam : Overseas Publ. Association, 1999. ISBN 90-5700-531-X, pp. 9-30.

3 STODOLA, Jiří. Analýza pojmu informace a jeho klasifikace s užitím aristotelské filosofie. *ProInflow* [online]. 10.07.2010 [cit. 2010-11-05]. URL: <http://pro.inflow.cz/analyza-pojmu-informace-jeho-klasifikace-s-uzitim-aristotelske-filosofie>. ISSN 1804–2406.

4 WIENER, N. *Cybernetics or communication and control in the animal and the machine*. 2nd. Ed. Cambridge, MA: MIT Press, 1948.

5 STONIER, T. Information as a basic property of the universe. *Bio Systems,* 1996, Vol. 38*,* pp. 135-140. ISSN: 0303-2647.

category of substance (that includes, for example, self-organizing systems[6] and the information which is related to property categories such as quality, quantity and relations. We can analogically predicate information about all the categories according to an analogy of proportionality; primarily, however, the term "information" shows a connection with three categories, namely quantity, quality and action (this is possible mainly for the reason that the analogy of proportionality virtually includes an analogy of attribution in which one subject is more fundamental than another one). Thus, we can predicate information about a concept and a gene because the concept relates to the mind in the same way as the gene to the body; yet, primarily, we predicate it about the concept.

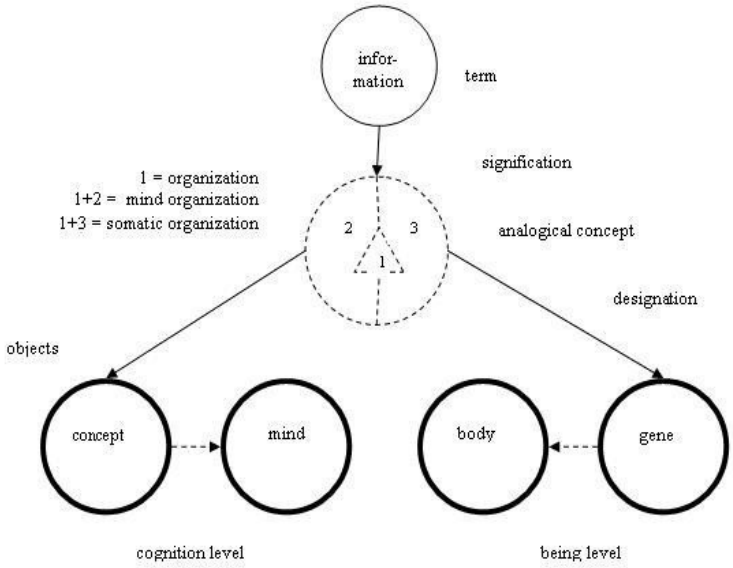

Fig. 1 Information as an analogical concept according to the analogy of proportionality

According to the previous distinction we can find three relevant levels of reality in which the term "information" can be used. The related levels are as follows:

1) the level of being (category of substance);
2) the level of cognition (category of immanent action as a first quality);
3) the level of interaction (category of transitive action).

6 MATURANA, H.R., VARELA, F. J. *Autopoiesis and cognition*. Dordrecht : The Netherlands : Reidel, 1980. ISBN 978-90-277-1015-4.

Every following level depends on the previous one. Using the levels, it is now possible to classify knowledge fields. We can apply the classification for identifying the formal subject of information science.

1) Natural sciences
1.1 about abiotic – physics, chemistry...
1.2 about animated – biology, botany...
1.3 about sensuous – zoology, ethology...
1.4 about rational – antropology, psychology...
1.5 abstractedly – mathematics, methaphysics
2) Cognitive sciences
2.1 about non-abstract cognition – psychology...
2.2 about abstract cognition – psychology, cognitive science
2.3 abstractedly – noetics...
3) System sciences
3.1 about abiotic systems – meteorology...
3.2 about biotic systems – ecology...
3.3 about culture systems
3.3.1 about abiotic culture systems – technics
3.3.2 about biotic culture systems – social sciences
3.4 abstractedly – theory of systems

Tab. 1 Sciences at three levels of reality

Number 2.2 corresponds to the representation paradigm, number 3.3.2 to the source-channel-receiver paradigm, and number 3.4 to the Platonistic one as according to Rafael Capurro.

The solution consists in the intersection of all paradigms, within which the cognitive one is more fundamental than the others. If we suppose that, in the first level of reality, a human being is analyzed as a psychosomatic person (1.4), then the second level is about a human abstract cognition (2.2) and the third level about knowledge communication between people (3.3). However, the knowledge communication system includes information creators and recipients. Their cognition pertains (2.2) to the second level, and their use of information (3.3.2) as

well as their information technology (3.3.1) relates to the third level. Hence, an information science subject lies in the intersection of the second and the third level.

Diagram 1 Information science as an intersection of three field at two levels of reality

As the second level is more fundamental than the third one, it is necessary to prefer a cognitive paradigm in information science. This does not mean that the social (source-channel- receiver) and technical (Platonistic) paradigms should be marginalized; rather than that, it is necessary to connect all the paradigms and, simultaneously, grant certain preference to the cognitive one as the more fundamental element. This conception corresponds with prof. Biagetti´s definition of information science: *Information and Library Science is part of a general Science of Communication* [the source-channel-receiver paradigm, 3.3.2] , *meaning Communication as a connection between external memories* [Platonistic paradigm, 3.3.1] *and cognitive system or knowing subject*[7] [the representation paradigm, 2.2].

3 The empirical argument

The second reason stems from the author´s library experience and from his research conclusions (GA406/09/0374). The previous research shows that

7 BIAGETTI, M. T. What is Information Science? What are its boundaries, and its basic building blocks? In Knowledge map of information science [online], [cit. 2011-04-11]. URL: <http://www.success.co.il/is/conceptions.html>.

information science should be interested in the problem of compensation for an information deficit resulting from cognitive disability. But information science does not sufficiently reflect this issue, and the obstacle is closely connected with the excessive triviality of the fact that information mediation also carries the meaning of making information sensible. This unsuspected trivial fact becomes important if we meet a visually or audially impaired person. Then, our common information code (visual or auditive) must be translated into another sense code, which is not so trivial as it may appear to be. For example, the information mediation from an author of a novel to a visually impaired reader requires multiple sensual translation. First of all, the author translates his auditive code (which consist in, for example, the spoken language) to a visual code (such as a type). Then, for example, the visual printing-published book has to be translated to an auditive code (such as a sound recording) or to a tactile code (such as a Braille book). A similar situation applies to a deaf person that uses the sign language. Hence, in the process of a university test preparation, it is necessary to prepare multiple versions to provide aid to students with some kind of cognitive disability. The group of special test versions may include the following elements:

- a large print version;
- a Braille version with some 3D object;
- a digital version that allows an auditive and tactile output (and also some 3D object);
- a sign language version.

A library for users with cognitive disabilities must not only attach, catalogue and mediate such versions of the document (which have to preserve the related information content), but also produce them. However, it has to be noted that the translation between different codes (by preserving the same information) is sometimes very difficult. For example, a university test may include the aspect of spatial imagination; in this case, 2D images need to be (for visually impaired students) represented by 3D objects. But if students manipulate with the 3D objects, their spatial imagination is not tested in any manner. Therefore, the above-discussed problems constitute the reasons for us to consider the cognitive paradigm in information science as a fundamental one.

4 Design of the following research

Even though the adequate paradigm selection is very important for the librarian profession, in the Czech milieu the complex problem of information science theory (and the cognitive paradigm in particular) was closely analyzed only by the

deceased professor Jiří Cejpek. The critical evaluation of various paradigms in information science should be the first research goal.

The existing modern libraries for the visually impaired people are equipped with systems (including special software and hardware) that make it possible for the librarians to work with disabled readers;, however, the incorporation of such technologies into librarian methodology has not as yet been sufficiently grounded on a theoretical basis.

The integration of cognitively handicapped persons into the information society can not be realized without the library or information science: the obvious reason for this statement consists in the fact that both these elements assure an efficient access to information. The research into the mediation of information to users with cognitive disability should become a subject of information science, and within this field it ought to be closely connected with special pedagogy and computer science. This type of research into information processes as related to cognitively disabled persons can constitute, together with the design of the cognitive paradigm in information science, the second goal of the research.

The centre of the following research should consists in an inquiry into the cognitive paradigm in information science with a view to persons facing cognitive disability such as blindness or deafness. The research into the problem of information mediation to users with a cognitive disability can provide certain results (observations) which may be generalized for the inquiry into the cognitive paradigm in information science. There are two main main research aims:

a) complete analysis and critical evaluation of various paradigms in information science;

b) design (proposal) of a cognitive paradigm in information science using the results coming from an inquiry into information procesess connected with cognitively disabled persons.

4.1 The methods of the research

Three elementary methods can be envisaged for the research: deduction, induction, and comparison. The formal subject of information science can be deduced from the philosophical classification of human knowledge using realistic philosophy; the reason for the application of this method consists in the fact that the author, in accordance with Luciano Floridi[8], considers the philosophy of information as the most important discipline for the constitution of a library and information science. Simultaneously, the data obtained from the inqury into

8 FLORIDI, L. On defining library and information science as applied philosophy of information. *Social Epistemology* [online]. 2002, Vol. 16, N. 1. s. 37-49. [cit. 2011-03-20] URL: <http://www.wolfson.ox.ac.uk/~floridi/pdf/isaspi.pdf>. ISSN 1464-5297.

information mediation to cognitively handicapped users should be generalized; in this connection, another significant aspect consists in the comparison of results stemming from the deduction and the induction. The research fields needed to facilitate the achievement of the research aim are as follows:

4.2 Deduction

- presentaton and critical evaluation of complete analysis pertaining to existing paradigms in information science;
- complete analysis of the concept of "information";
- classification of the concept according to the previous conclusions concerning the concept status;
- analysis of the concept of "system" and its classification;
- design (proposal) of knowledge organization and the submission of information science into a system of sciences;
- research into human cognition fundamentals;
- design of the cognitive paradigm in information science;

4.3 Induction

- analysis of the production, coding, acquisition, organization, mediation and using of information (with a view to persons having cognitive disability) by the help of empirical methods of information science;
- design of cognitive paradigm in information science.

4.4 Comparison

- comparison of results stemming from the deduction and induction;
- harmonisation of the results.

The research methods are displayed in the following schema:

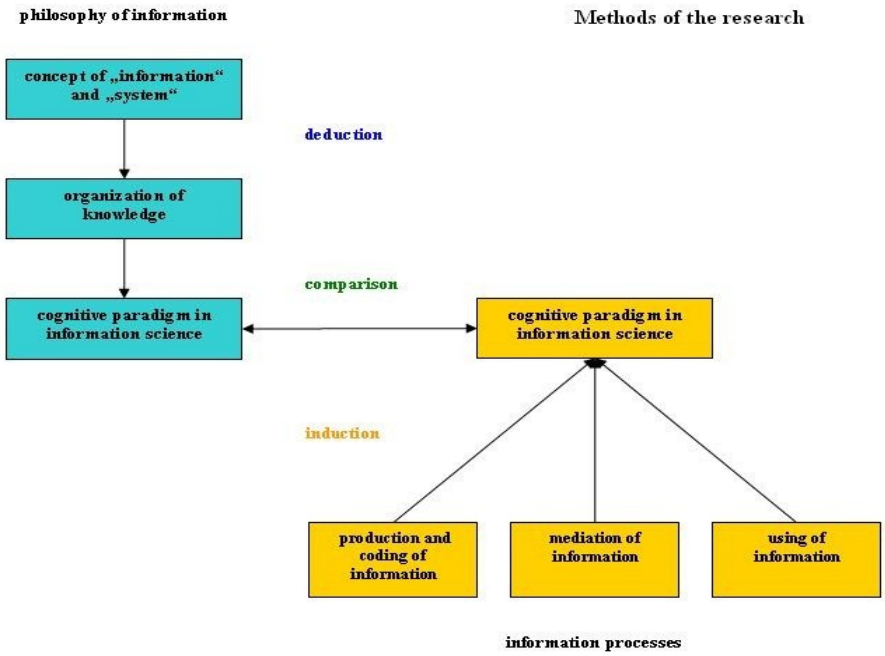

Fig. 2 Methods of the research

5 Conclusion

The brief introduction to the three main paradigms of information science was presented in the article. We could also become aquainted with two basic arguments, according to which the author is convinced, that the cognitive paradigm in information science is the fundamental one. The short introduction of the possible new research was presented in the final part of the article.

Acknowledgement

The article was supported by project GA406/09/0374.

Bibliography

1. BIAGETTI, M. T. What is Information Science? What are its boundaries, and its basic building blocks? In *Knowledge map of information science* [online], [cit. 2011-04-11]. URL: <http://www.success.co.il/is/conceptions.html>.
2. CAPURRO, R. Is a unified theory of information feasible*?* In HOFKIRCHNER, W., ed.: *The quest for a unified theory of information : proceedings of the Second international conference on the foundations of information science*. Amsterdam : Overseas Publ. Association, 1999. ISBN 90-5700-531-X, pp. 9-30
3. CAPPURO, R. What is information science for? A philosophical reflection. In *Conceptions of Library and Information Science : Historical, empirical and theoretical perspectives*. London : Taylor Graham, 1992. ISBN 0-947568-52-2, pp. 82-98
4. FLORIDI, L. On defining library and information science as applied philosophy of information. *Social Epistemology* [online]. 2002, Vol. 16, N. 1. s. 37-49. [cit. 2011-03-20] URL: <http://www.wolfson.ox.ac.uk/~floridi/pdf/isaspi.pdf>. ISSN 1464-5297.
5. FLORIDI, L. *What is the philosophy of information?* [online]. 2002, [cit. 2010-04-10].
6. URL: <www.blackwellpublishing.com/pci/downloads/introduction.pdf>.
7. FLORIDI, L. *Open problems in the philosophy of information* [online]. 2004, [cit. 2010-04-10]. URL: <http://groups.inf.ed.ac.uk/ppig/readinglist/information3.pdf>.
8. MATURANA, H.R., VARELA, F. J. *Autopoiesis and cognition*. Dordrecht : The Netherlands : Reidel, 1980. ISBN 978-90-277-1015-4.
9. STODOLA, Jiří. Analýza pojmu informace a jeho klasifikace s užitím aristotelské filosofie. *ProInflow* [online]. 10.07.2010 [cit. 2010-11-05]. URL: <http://pro.inflow.cz/analyza-pojmu-informace-jeho-klasifikace-s-uzitim-aristotelske-filosofie>. ISSN 1804–2406.
10. STODOLA, Jiří. *Informace, komunikace a bytí : fragment realistické informační vědy*. 1. vyd. Brno : Stodola, 2010. 146 s. ISBN 978-80-254-7996-4.
11. STONIER, T. *Information and the Internal Structure of the Universe : An Exploration into Information Physics*. London : Springer, 1990. ISBN 3-540-19599-8.

12. STONIER, T. Information as a basic property of the universe. *Bio Systems,* 1996, Vol. 38*,* pp. 135-140. ISSN: 0303-2647.
13. WIENER, N. *Cybernetics or communication and control in the animal and the machine*. 2nd. Ed. Cambridge, MA: MIT Press, 1948.