

Abstract

Information analysis of Foundation of Information Science (FIS) information exchange[†]

Moisés André Nisenbaum ¹, Lena Vania Ribeiro Pinheiro ² and Jose Abdalla Helayël - Neto ^{3,*}

¹ Instituto Federal de Educação, Ciência e Tecnologia do Rio de Janeiro - IFRJ; moises.nisenbaum@ifrj.edu.br

² Instituto Brasileiro de Informação em Ciência e Tecnologia - IBICT; lenavania@ibict.br

³ Centro Brasileiro de Pesquisas Físicas - CBPF; josehelayel@gmail.com

* Correspondence: moises.nisenbaum@ifrj.edu.br; Tel.: +55-21-25667701

† Presented at the IS4SI 2017 Summit DIGITALISATION FOR A SUSTAINABLE SOCIETY, Gothenburg, Sweden, 12-16 June 2017.

Academic Editor: Mark Burgin,

Received: 2017-04-14; Accepted: 2017-04-18; Published: 9 June 2017

Abstract: Quantitative analysis of messages from the Foundations of Information Science (FIS) mailing list posted from between December 6, 1997 and November 29, 2016. Messages, their authors and dates are taken from the official FIS website. Messages are classified according to the main topics of discussion, through the analysis of the titles, in order to identify the main authors and topics discussed over the years. Then, the textual analysis of the messages of each topic is carried out to determine the specific vocabulary of each subject. The results show that the discussions are, in general, multidisciplinary, with topics independent of each other. The most discussed topics were "Information and Physics" and "Definition of Information" and the top 10 authors participated, on average, in 72% (23 of 32) of the topics.

Keywords: Information Science; Interdisciplinarity; Foundations of Information Science (FIS); Mailing List.

1. Introduction

Information Science (IS) is a relatively new science that emerged after the Second World War, influenced by Bush's [1] ideas, from the perspective of managing scientific information [2] or, according to some theorists, Otlet's [3] thinking about documents and documentation. The first formulation of Information Science's modern concept, occurred during two meetings at the Georgia Institute of Technology [4]. Following these two meetings its interdisciplinary character started to get recognized, but not explicitly, by most authors. In particular, in Brazil, this issue has been debated epistemologically [5]. Although documenting and retrieving information was its initial motivation, IS has grown and now studies Information in categorized contexts, for example in the US, by Asis&t's Special Interest Groups (SIGs) and in Brazil by Ancib's Working Groups. According to the classification of the areas of knowledge of the National Counsel of Technological and Scientific Development (CNPq), Information Science is an Applied Social Science. The historiography of the area has elicited perspectives and approaches that today place IS into a new sociological and humanistic approach, in which pragmatism and fields, such as Philology and Philosophy, play a relevant role in the epistemological re-discussion of IS.

The Foundations of Information Science (FIS - <http://fis.sciforum.net/>), an informal endeavor promoted by Michael Conrad and Pedro Marijuan, has been an attempt to "rescue the information concept out from its classical controversies and use it as a central scientific tool". In this way, from the point of view of the FIS, Information Science is a more comprehensive domain, that is, it is one of the four main pillars of science, together with the Physical, Biological and Social sciences. This long-term project, which began in 1992, discusses its ideas in a permanent electronic mailing list

established since 1997 and in biannual conferences (Madrid 1994, Vienna 1996, Paris 2005, Beijing 2010, Moscow 2013, Vienna 2015 and Gotemburg 2017). The board of the FIS initiative is composed of a multidisciplinary group of 18 members (<http://fis.sciforum.net/fis-board/>) and the FIS mailing list has 351 members as of April 10, 2017. Yan Xueshan analyzed the content of the FIS messages from 1997 to 2007, extracting and discussing the approaches of the list members on topics of "Information Concepts", "Physical Information", "Bioinformatics", "Information society", "Other Information" and "Information Science" [6].

The results of this research show that Information Concept and Information in Physics are the two most discussed topics in the FIS List. It is also known that it is not possible to define Information uniquely, because it depends on the context [7,8]. The possibility of a consensus could come through a non-reductionist theory that unifies the concepts of information [9]. In addition, Bais & Farmer [10], who describe the central role of information in thermodynamics, statistical mechanics, chaos theory, computer science, quantum theory and astrophysics, have reviewed the concept of information in the context of Physics.

2. Objective

The objective of this research is to perform a quantitative analysis of FIS's mailing list messages with the purpose of 1) classifying them into topic groups; 2) evaluating their evolution over time; and 3) identifying their main authors. A total of 5,375 messages exchanged between December 1997 and November 2016 were considered.

3. Methodology

The FIS list is an electronic forum for email exchange hosted by servers at the University of Zaragoza, Spain, where the list's moderator, Pedro C. Marijuán, works. All messages used as data source for this analysis are available in three sites: Site 1 (1997-2007): <http://fis-mail.sciforum.net/>; Site 2 (February 2006-present): <https://www.mail-archive.com/fis@listas.unizar.es/maillist.html>; and Site 3 (April 2014 – present): <http://listas.unizar.es/pipermail/fis/>. Site 1 is a static repository, Sites 2 and 3 are updated daily, outside and inside the university server, respectively. Sites 1 and 2 were downloaded using HTTrack Website Copier software, and all 5,375 FIS mailings, between December 6, 1997 and November 29, 2016, have been saved on a local computer. Each message is stored individually as an html file, but the message's index, containing title, upload date and author, is displayed on one page on Site 1 and 16 pages on Site 2. Site 3 was not used in this search because of overlap with Site 2 messages.

The methodological procedures of this research were carried out in four steps:

Step 1: Export to Excel - The content of each message index was exported to an Excel spreadsheet which included four columns: message subject, author, date of posting, and html file name.

Step 2: Message Classification - A Discussion Topic was assigned to each message, based on the 50 topics available at <http://fis.sciforum.net/fis-discussion-sessions/> (accessed November 29, 2016). The classification was based on content analysis of the first message of each thread and extended to their responses. We identified 19 additional new topics during this analysis, resulting on a total of 69 topics.

Step 3: Grouping topics - Similar topics were grouped together. We added the topic: "Administrative" for administrative messages, usually authored by the list moderator; "Announcement" for communications related to conferences and call for papers; and "Other Topics" for some messages that did not fit into any of the Grouped Topics.

Step 4: Compilation of results – We used Excel data analytical tools, mainly Pivot Table, for extracting and tabulating quantitative data that, together with content analysis, served as the basis for the interpretation of the results.

4. Results

The 5,375 messages posted on the FIS mailing list between December 6, 1997 and November 29, 2016 were classified into 32 Grouped Topics, as shown in Table 1.

Table 1. Foundations of Information Science 5,375 messages classified into 32 Grouped Topics from 1997 to 2016.

Rank	Grouped Topic	1997-2001	2002-2006	2007-2011	2012-2016	Total
	All Topics (Number, %)	407 (8%)	2,096 (39%)	1,178 (22%)	1,694 (32%)	5,375
1	Information and Physics	36	585	98	359	1,078
2	Announcement	119	331	171	203	824
3	Definition of Information	17	190	168	239	614
4	Social Information	79	57	64	144	344
5	Biological Information	52	140	21	31	244
6	Information and Neuroscience	0	11	85	117	213
7	Information and Meaning	3	112	85	8	208
8	Administrative	22	79	62	22	185
9	Science	7	20	68	74	169
10	Phenomenology	0	0	0	167	167
11	Information and Economic	0	95	24	12	131
12	Information Theory	0	5	114	8	127
13	Information and Philosophy	12	44	0	64	120
14	Information and Logic	0	0	102	9	111
15	Semiotics	0	19	0	75	94
16	Consilience	0	91	0	0	91
17	Information and Chemistry	0	43	43	0	86
18	Informaion Science	6	0	39	30	75
19	Information and Ethics	0	66	0	0	66
20	Bibliometry	0	58	0	0	58
21	Information and Knowledge	0	18	34	0	52
22	Ecological Economics and Information	0	45	0	0	45
23	Scientific Commuication	0	0	0	44	44
24	Information and Mathematics	0	0	0	36	36
25	Information and Music	0	35	0	0	35
26	Information and Natural Languages	33	0	0	0	33
27	Information and Art	0	26	0	0	26
28	Information, Communication and Life	0	0	0	26	26
29	Other topics	9	11	0	4	24
30	Consciousness	12	0	0	11	23
31	Information and Symetry	0	15	0	0	15
32	Information and Computing	0	0	0	11	11

The most discussed Grouped Topic was "Information and Physics" which included the following topics: Information & Physics (1998), Information Physics (2002), Entropy and Information: Two Polymorphic Concepts (2004), Quantum Information (2006), The Nature of Microphysical Information: Revisting the Fluctuon Model (2010) and Quantum Bayesianism (QBism) - An interpretation of quantum mechanics based on quantum information theory (2014). The recurrence

of the subject over the years and the number of messages (1078) indicate that information in the context of Physics is important to FIS list members.

The question "What is information?" appears on the FIS homepage (<http://fis.sciforum.net/>), so it was not surprising that "Definition of Information" occupied an important position in the ranking, here found to be in third place. There were three long discussions in 1999, 2015 and 2016, representing approximately 11% of all 5,375 messages. This topic also permeates the messages of other topics, since the concept of information is usually defined and/or questioned before the discussions. The definitions themselves and epistemological questions are discussed in the messages and one of the consensuses is that the concept of information is context dependent.

Surprisingly, "Information Science" was ranked in 18th place, an apparent contradiction to the list name and purpose.

The other lower ranking grouped topics were, most of the time, chosen according to the specialties of the leaders of the discussions.

Table 2 shows the 10 most productive authors on the FIS mailing list, the number of their documents indexed in the Scopus database, and their respective areas of interest retrieved from official sites and authors' CVs.

Table 2. List of the 10 most productive authors in the Foundation of Information Science (FIS) list, number of messages posted on FIS list and documents indexed by Scopus

Author	Number of messages on FIS list	Number of documents indexed by Scopus	Areas of interest
Pedro C. Marijuan	871	34	Information Sciences, Biology, Neuroscience
Loet Leydesdorff	394	344	Physics, Biology, Philosophy, Bibliometrics
Stanley N Salthe	339	57	Biology, Philosophy, Physics
John Collier	220	27	Philosophy, Biology, Information Theory, Systems Theory
Joseph Brenner	202	20	Theory and Philosophy of Information, Logic, Physics
Jerry LR Chandler	178	27	Chemistry, Biochemistry, Genetics, Complex Systems, Physics, Medicine
Karl Javorszky	176	1	Philosophy, Epistemology, Psychology
Rafael Capurro	156	19	Philosophy, Ethics, Information in social contexts
Søren Brier	125	29	Philosophy of science, Cybersemiotics, Biology
Steven Ericsson-Zenith	118	0	Biophysics, Computation, Bioengineering, Theory of Mind, Cosmology, Logic, Semiotics
Totals	2779	558	

The areas of interest comprise a multidisciplinary network that involves the discussions of the list in diverse contexts and points of view. In fact, the top 10 authors participated, on average, in 72% (23 of 32) of the Grouped Topics.

The number of co-authorships among the 36 main authors (not all listed in Table 2) is small. In fact, of 2,165 documents indexed in the Scopus database for these authors, only eight were produced

together. Therefore, belonging to the FIS list does not seem to promote collaboration among its members.

Diversity of areas of interest and low number of co-authorships suggest that the cross disciplinary collaboration of FIS list takes place at the level of multidisciplinary, the first of the three levels defined by Pombo [11]. This can be evaluated in future work that analyzes the relationship between threading and interdisciplinarity [12]. Unfortunately, since it is customary for FIS members to change the message subject when replying to a message, it will be challenging to count specific threads, which is essential for this type of analysis. One solution would be to suggest to the group of list participants that they preserve this "metadata" (i.e., message subject) to facilitate future research. In this sense, analyses of co-authorship and co-citation among group members, thus grouped, could reveal signs of interdisciplinarity.

We hope, with this communication, to pave the way for a deeper and more systematic study of the contents of the FIS-list messages, in order to index them so that their discussions serve as a basis for future research.

References

1. Bush, V. As We May Think. *Atl.* **1945**, *176*, 101–108.
2. Wersig, G.; Neveling, U. The phenomena of interest to information science. *Inf. Sci.* **1975**, *9*, 127–140.
3. Otlet, P., *Traité de documentation : le livre sur le livre, théorie et pratique*. Eds Mundaneum: Bruxelles, Belgium, 1934.
4. Conferences on Training Science Information Specialists, 12-13 October 1961, Atlanta. 12-13 April 1962, Atlanta. *Proceedings*. Atlanta: Georgia Institute of Technology, 1962. (Sponsored by the National Science Foundation)
5. Pinheiro, L.V.R., Configurações disciplinares e interdisciplinares da Ciência da Informação no ensino e pesquisa no Brasil. In *A ciência da informação criadora do conhecimento*; Borges, M.M, Sanz Casado, E., Eds.; Imprensa da Universidade de Coimbra: Coimbra, Portugal, 2009; Volume 1, pp. 99–111.
6. Yan, X. *Information Science: Concept, System and Perspective*; Science Press: Beijing, China, 2016; pp. 587-638.
7. Capurro, R. & Hjørland, B. The concept of information. *Annual Review of Information Science and Technology* **2003**, *37*, 343–411.
8. Logan, R. K. *What is Information?: Propagating Organization in the Biosphere, Symbolosphere, Technosphere and Ecosphere*; DEMO Publishing: Toronto, Canada, 2014.
9. Capurro, R.; Fleissner, P.; Hofkirchner, W. Is a unified theory of information feasible? A dialogue. *World Futur. J. Gen. Evol.* **1997**, *49*, 213–234.
10. Bais, F. A.; Farmer, J. D. The Physics of Information. *arXiv Prepr.* **2007**, arXiv:0708.2837.
11. Pombo, O. *Interdisciplinaridade: Ambições e Limites*; Relógio D'Água Editores: Lisboa, Portugal, 2004.
12. Zelman, A.; Leydesdorff, L. Threaded email messages in self-organization and science & technology studies oriented mailing lists. *Scientometrics* **2000**, *48*, 361–380.



© 2017 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>)