Towards a transdisciplinary frame: Bridging domains, a multidimensional approach to information

José María Díaz Nafria, Francisco Salto
Sumary

1. Striving for a transdisciplinary frame on information
2. What might be pursued?
3. A methodological proposal for interweaving the field
   3.1 Domains and frameworks
   3.2 Interweaving the field
4. domusBITae: a virtual research community as a step to erect a new Science of Information
1. Striving for a transdisciplinary frame

- In the Information Era, shouldn’t we be able to give account of what information really is? What for? To solve our problems (practical or scientific), preserve the interests at stake...

- However, in the I.S. it seems natural to assume without further critical reflection disunited uses of “information” in: formal science | natural sciences (physics, chemistry & biology) | social sciences | technical science | ethics & philosophy. Are they non-reducible concepts?

- 3 effects of the manifold usage: (1) scattering effect -many meanings, misunderstanding, (2) possibility to bridge traditionally divided sciences (physics—biology—cognitive sc.—sociology), (3) belief that information can be useful for everything.

- Since we are appealing to the very core of different sciences, a clarification of information phenomena rendering scientific and societal fruits must be multidimensional and trans-disciplinary.
Refining questions on information

- Is there a unified understanding of information under all these uses of “information”?

- How can we simultaneously grant the diversity of information phenomena and the rigour of its theoretical apprehension in a unifying framework?

- Could a refined concept of information bridge over matter and energy (physics), life (biology), cognition and consciousness (psychology and neuroscience) and social systems (sociology)?

- How can we preserve all practical interests regarding information (from the governing of nature or the implementation of technology to the preservation of social rights, cultural life, human dignity...)?
1. Striving for a transdisciplinary frame

- There is work division in Science & Technology based on:
  1. Assumption of analyticity of reality (rooted in modernity),
  2. Increase in observation means (affecting since the 18th century),
  3. Complexity of systems (exponentially related to N),

- The problems of social **LIFE** are not analytical, they need an overarching approach (¬1) if the main problem of the Information Society is how to handle/ manage/ produce/use information for meeting social needs → we need a general approach to information.

- The traditional **organization of Academia**, based upon the \{analyticity of reality + trust on methodology\} **POSITIVISM** hinders a general approach, though there are relevant theories in **formal, natural, social sciences and humanities**.
1. Striving ... (diversity)

Ontological vs epistemological approaches

Objective or subjective?

Relational concept, dependent on:

Uncertainty, probability
Measurement
Structure and process
Structure and behavior, Evolution
Interpretable and generating
Release mechanism

Subjectivity or Intencionality

Abstract
General
Human

Ontological category
independent

Subjective concept

Theory of Objective Information
Ciber-néctics
MTC
Shannon Weaber
Wiener Günther
Stonier Gitt

General Theory of Measure ment
v. Neuman Brillouin Mähler

Algorithmic Information Theory
Solomonoff Kolmogorov Chaitin

Unified Theory of Information
Hoffkirchner Fleissner Fenzl Lazo
Brier (Cibersemiotics)

Objectivised Semantics
Weizsäcker Lyra (Quantic T. of Inf.)
Matsumo (Diacronic I.)

Karpatshof (Activity Theory)

Semantic Theories of Information
Bar-Hillel y Camap
Situational Barwise
Perry, Seligmam
Israel Truthfulness Floridi

Biology
Maturana, Varela
2nd O. Cibernetics
V. Foerster
Cognitive Dretske

Relevance Decision T.
Racionality T.
Inf. Hermeneutics
Capurro
Intersubj. Knowledge
Oeser

Dependiente de
mental Difference
Flückiger
Selfreferent. Sist T.
Luhmann
Cognitive Science

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Bridging domains: a multidimensional approach to information
1. Striving ... (diversity)

Dimensions being covered?

- **Syntactical**
  - *How is it expressed?*
  - MTC (Shannon, Weaver)
  - Holographic Universe (Bekenstein)
  - Quantum Theory of Information and Measurement (Lyre, Mahler...)
  - Objectivised semantics (Weizsäcker, Lyre)
  - Cybersemiotics (Brier)
  - UTI (Hoffkirchener, Fleissner, Fenzl, ...)

- **Semantic**
  - *What does it represent? Is it true?*
  - Logical empiricism (Bar-Hillel, Carnap)
  - Cognitive constructivism (Dretske)
  - Situational semantics (Barwise, Perry, Seligman...)
  - Fuzzy semantics (Zadeh, Pérez-Amat...)
  - Theory of Self-referential Systems (Luhmann)

- **Pragmatic**
  - *What value does it have?*
  - Algorithmic Information Theory (Solomonoff, Kolmogorof, Chaitin)
  - Theory of purpose-oriented action (Janich)
  - Activity Theory (Karpatschof)
  - Aesthetic Theory of Information (Bense, Moles)

- **Syntactical**
  - *How is it expressed?*
  - Theory of Objective Information (Stonier, Gitt)

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*Bridge domains: a multidimensional approach to information*
a) **Ways of thinking**, or how identity and difference are thought to relate each other (Hofkirchner).

<table>
<thead>
<tr>
<th>Ways of thinking</th>
<th>Relationship between lower and higher complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reductionism</strong></td>
<td>reduces higher complexity to lower complexity</td>
</tr>
<tr>
<td><strong>Projectionism</strong></td>
<td>projects higher complexity onto lower complexity</td>
</tr>
<tr>
<td><strong>Disjunctivism</strong></td>
<td>disjoins higher complexity from lower complexity</td>
</tr>
<tr>
<td><strong>Integrationism</strong></td>
<td>integrates lower complexity into higher complexity which it differentiates from the former</td>
</tr>
</tbody>
</table>

b) Top-down and Bottom-up approximation in the foundation of information science (Brier).

- Hierarchy of sciences and arts
  - Humanities
  - Social Sciences
  - Psychological sciences
  - Biological sciences
  - Chemical sciences
  - Physical sciences

View on the foundation of information/signification

- Semiotical view
- Informational view

**System th. + Semiotics (Peirce)**

**Cybersemiotics**
1. Striving ... (unifying)

**UTI**
- Information ~ Emergence
- S-O Matter
  - Self-structuring
  - Causal Reason
- S-O Biotic-Life
  - Self-Reproduction
  - Functional Reason
- S-O Social-Life
  - Self-Re-creation
  - Intentional Reason

\[ Evolving \, SIGN \mid Information \]

**GTI**
1) **Timely** distinctions:
   - potential-, existential- and actual \( I_M \)
2) **Structural** distinctions:
   - External-, intermediate-, internal \( I_M \)
3) **Constructivist** distinction:
   - Abstract-, realistic-, experiential \( I_M \)
4) **Triad**: \((S, I, E)\)
   - Integrates \{syntactical (Shannon) + semantic (Barwise) + pragmatic (Weizsäcker) aspects\}
   - Extension of A.I.T. \( \supset \)
     \{Mathematical & Formal Theories in a Pragmatic-Semantic theory\}
2. What might we pursue?

1. **Interdisciplinary work**: tools for *sharing* data, documents on theoretical grounding | mutual *comprehension* and *criticism*.

2. Clarification of the concepts, metaphors, terminology and involved theories, in order to enable a *mutual understanding*.

3. Searching for the most **overarching account** of information phenomena (mostly unifying perspective) through careful levels of abstraction.

4. Searching for **better formalisations** of real processes (material, biotic, cognitive, communicative, social).

5. **Global stance toward problems** related to information (first plane moral issues and social interests).

6. Bringing about new insights into the steering and design of **information technologies** at personal and social levels.

7. Foundations of an effective transdisciplinary **Science of Information**.
3. Methodological proposal for interweaving the field

Babel vs Pentecost

The Babel of specialism

Reasons for being in the middle:

Reality is globally structured (systematic)

Knowledge limitation

We can articulate specialist truth into an general one

The Pentecost of a unique unified perspective
3.1 Domains and Frameworks

Broad nature of information: natural, social and technical world

Research domains:

- **Formal** aspects of information (mathematical and logical topics)
- **Physical** sciences (physical and chemical topics)
- **Life** sciences (biological topics)
- **Cognition** and psychology (epistemological, cognition, consciousness and other psychological topics)
- **Information and Communication Technologies** (engineering, social and anthropological topics concerning ICT)
- **Social sciences** (communication, information society, economical, sustainability topics)
- **Ethics** (ethical, information divide, political and legal topics)
3.1 Interweaving the field

Transversal coordination | Meetings |
Glossary on concepts, metaphores, concepts and problems on Information
3.1 Interweaving the field (glossary)

http://glossarium.bitrum.unileon.es/glossary
3.1 Interweaving the field (glossary)
4. domusBITae: a virtual research community as a step to erect a new Science of Information

No. of communities of Information Studies

a) Geographical divide

<table>
<thead>
<tr>
<th>Country</th>
<th>N</th>
<th>Country</th>
<th>N</th>
<th>Country</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>1</td>
<td>France</td>
<td>3</td>
<td>Romania</td>
<td>1</td>
</tr>
<tr>
<td>Australia</td>
<td>7</td>
<td>Georgia</td>
<td>1</td>
<td>Singapore</td>
<td>1</td>
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<tr>
<td>Austria</td>
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<td>Germany</td>
<td>25</td>
<td>Slovakia</td>
<td>1</td>
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<tr>
<td>Belarus</td>
<td>1</td>
<td>Greece</td>
<td>1</td>
<td>Slovenia</td>
<td>3</td>
</tr>
<tr>
<td>Belgium</td>
<td>6</td>
<td>Hungary</td>
<td>2</td>
<td>Spain</td>
<td>2</td>
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<tr>
<td>Brazil</td>
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<td>Ireland</td>
<td>3</td>
<td>Sweden</td>
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<tr>
<td>Bulgaria</td>
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<td>Israel</td>
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<td>Switzerland</td>
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<td>Canada</td>
<td>8</td>
<td>Italy</td>
<td>4</td>
<td>Taiwan</td>
<td>1</td>
</tr>
<tr>
<td>Chile</td>
<td>1</td>
<td>Japan</td>
<td>6</td>
<td>Thailand</td>
<td>1</td>
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<tr>
<td>Croatia</td>
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<td>Lithuania</td>
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<td>United Kingdom</td>
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<tr>
<td>Czech Republic</td>
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<td>Netherlands</td>
<td>4</td>
<td>U.S.A.</td>
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<tr>
<td>Denmak</td>
<td>1</td>
<td>New Zealand</td>
<td>1</td>
<td>Venezuela</td>
<td>1</td>
</tr>
<tr>
<td>Estonia</td>
<td>1</td>
<td>Norway</td>
<td>1</td>
<td>No located</td>
<td>27</td>
</tr>
<tr>
<td>Finland</td>
<td>4</td>
<td>Portugal</td>
<td>1</td>
<td>Total</td>
<td>316</td>
</tr>
</tbody>
</table>

b) Speciality divide

<table>
<thead>
<tr>
<th>Type of studies</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artificial Intelligence</td>
<td>49</td>
</tr>
<tr>
<td>Cognitive Science</td>
<td>38</td>
</tr>
<tr>
<td>Communication Science and Media Studies</td>
<td>27</td>
</tr>
<tr>
<td>Computer Science</td>
<td>51</td>
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<tr>
<td>Cybernetics</td>
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<tr>
<td>Information Science</td>
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<tr>
<td>Information Society Research</td>
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<tr>
<td>Internet Research</td>
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<tr>
<td>Knowledge Studies</td>
<td>18</td>
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<tr>
<td>Library Science</td>
<td>16</td>
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<tr>
<td>Philosophy of Information and Information Ethics</td>
<td>20</td>
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<tr>
<td>Research on ICTs</td>
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<tr>
<td>Science of Complexity</td>
<td>22</td>
</tr>
<tr>
<td>Semiotics</td>
<td>12</td>
</tr>
<tr>
<td>Systems Theory</td>
<td>27</td>
</tr>
</tbody>
</table>
4. domusBITae: virtual research community

- Due to: (i) structural limitations of academia, (ii) scientific domain divide, (iii) interest divide → We need a space to progressively bridge the community.

- Lets provide technical bridges for the research communities to enable a self-organization of the general approach to information.

- There is an European Program (EC) in e-Infrastructures, aimed at finding new paths in scientific research through ICTs (driven by the e-Infrastructures Reflection Group, eIRG).
4. domusBITae: virtual research community

It pursues bridging horizontally the whole community of information studies in order to:

(a) share resources and results,
(b) improve communication,
(c) foster discussion, scientific knowledge & innovation,
(d) disseminate results and
(e) promote cooperative research.
4. domusBITae: virtual research community

1. A *knowledge oriented content manager* adaptable for any community of information studies, and enabling direct access to both resources of the virtual community and other groups;

2. A *directory of communities* which will serve as a bridge between communities;

3. An *institutional and thematic repository* for Information Studies;

4. A *toolkit for working groups* to facilitate collaborative research (including e-Meeting Room);

4. domusBITae (modular structure)
4. domusBITae (glossary)

- Disambiguation
- Multiperspective account on problems
- Adress: concepts, metaphores, theories, problems
- Scientific peer-review of contributions
- Open authorship in articles
- Open discussion
4. domusBITae (glossary)

1. Gathering an incipient Consortium [BITrum, SCII (USA), UTI (AT), FIS, UB (SP), UC3M (SP), University Aegean (GR), Copenhagen Business School (DK), University of Szeged (HU)] + Scientific Committee

2. Developing of Glossarium BITri as a stage of an intercommunity-glossary

3. Search for National Support (FP7 preparation, further steps)

4. Strengthening of Consortium by presentation in international meetings (ICT&S, today, European e-Infrastructures)

5. Preparation of FP7 Proposal (deadline: november) (Capacities/e-Infrastructures)

6. Development at international level
5. Conclusions

- We need a **general understanding** on information to face social/technical/social **challenges**.
- We need to keep in the middle (Babel vs. Pentecost): interdisciplinarity→ transdisciplin.
- We need a **multiperspectivistic** approach to let every perspective leverage common understanding, science advancement and addressing problems (human, social, technical).
- The **virtual research community** might provide: (i) a step for erecting the Science of Information; (ii) a space and support for existing as international community; (iii) means for coordinating, investigate and disseminate.
- We have now the opportunity to make a proposal, all of you are kindly invited.
Thank you for your attention