

Inter-Disciplinary Communication Rigor¹

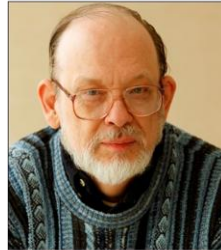
*International Institute of Informatics and Systemics (IIIS, www.iiis.org)
Journal of Systemics, Cybernetics and Informatics (JSCI, <http://www.iiisci.org/journal/sci/EditBoard.asp?var>)*

(Initial Seed/Base Draft)



Dr. Nagib Callaos

**President of the Int. Inst. of Informatics and Systemics, USA
Former Dean of Research at University Simón Bolívar, Venezuela
Editor in Chief of the Journal of Systemics, Cybernetics and Informatics**



Professor Thomas Marlowe

**Seton Hall University, USA
Department of Mathematics and Computer Science
Program Advisor for Computer Science
Doctor in Computer Science and Doctor in Mathematics**

The purpose of this short article is to trigger an Inter-Disciplinary Dialogic on the Topic of “Inter-Disciplinary Communication Rigor” which may also be called “Inter-Disiplinary Dialogic Rigor”.

The phrase “Inter-Disciplinary Dialogics” was inspired by Jeremy Horne’s informal communication (as yet unpublished article), entitled “Unedited notes on interdisciplinary communications – historical perspective, rigor and current situation,” In this short article, Jeremy Horne made a very brief historical account of issues related to “Inter-disciplinary communication”. In this context, he mentions “Aristotle’s Dialogic”. Here we are using the term “dialogics” in its general meaning (increasing consensus via collective construction of ‘logos’), which includes “Aristotle’s Dialogic”. In its general sense, Dialogic is the kind of communication that is implemented via Dialogue. Interdisciplinary Communication, as a dialogue, i.e. as a dialogical inter-disciplinary communication has been presented with more details in (Callaos & Horne, 2013)

Wilhelm von Humboldt (1836) was one of the precursors who perceived the necessity of inter-disciplinary communication or, more precisely, inter-disciplinary dialogues. He affirmed:

“With a clear and immediate sense of his immutable limitations, man is bound to regard truth as something lying outside him: and one of the powerful means of approaching it, of measuring his distance from it, is social communication with others. All speaking, from the simplest kind onwards is an attachment of what is individually felt to the common nature of mankind.” (Humboldt, 1988 edn.: 57)

We might say, via analogical thinking. We might paraphrase Humboldt, suggesting that disciplines (or disciplinarians), with “a clear and immediate sense of [their] immutable limitations” [they are] bound to regard truth as something lying outside [them]: and one of the

¹ We are using the word “Rigor” in the context of “Intellectual Rigor”: logical and/or methodological rigor, i.e. subject and complying with logical and/or methodological rules, restrictions and standards.

powerful means of approaching it, of measuring his distance from it”, in inter-disciplinary communication or dialogs.

Elsewhere, we examined the meaning and the importance of interdisciplinary communication. (Callaos & Horne, 2013) (Callaos N., 2017) Here we will, very briefly, refer to what is, or should be, rigorousness in the context of interdisciplinary communication. One frequently reads, or hears, that interdisciplinary research, education, and/or communication is not rigorous. This is far from the truth, if the communication is based on rigorous and critical thinking, and especially if it is based on a previous intra-disciplinary peer review, or the interaction of several works that have sustained such review, potentially in different disciplines.

We will show that, contrary to what some disciplinarians believe, a rigorous inter-disciplinary communication could even be more rigorous than intra-disciplinary communication. This is especially correct in situation C described below, which will be the means with which we will start the project of *interdisciplinary written communication* conceived as a complement to the verbal inter-disciplinary communication that the International Institute of Informatics and Systemics (IIS) has been implementing through its conferences during 23 years.

This is a very short article oriented to communicate the reasoning supporting what we just wrote in *order to collect more information, knowledge and opinion* (Episteme and Doxa) with regards to this issue. In order to provide a brief context for the following three listed situations, let us mention what highly referenced authors wrote with regards to “inter-disciplinary rigor”.

To the best of our knowledge, the most comprehensive book on Interdisciplinarity was authored by Julie Thompson Klein (*Interdisciplinarity: history, theory, and practice*, 1990). About the 40% of the book consists of her references. With regard to interdisciplinary rigor, she wrote:

Interdisciplinary work is often attacked for lacking rigor. However, rigor is not diminished. Rather, it is shifted from disciplinary criteria to a new interdisciplinary *objective*, to what (Singleton, 1983) call a core sense of “interdisciplinary rigor.” There are no scholarly defined standards for judging interdisciplinary works but Stephen Schneider’s three criteria for disciplinary excellence are quite appropriate. Excellence of interdisciplinary research can be measured in terms of (1) disciplinary clarity, (2) clarity of cross-disciplinary communications, and (3) the utilization and combination of existing knowledge from many fields to help solve a problem or to raise or advance knowledge about a new issue (Schneider, 1977).

From a more general perspective, Jeremy Horne², referring to an achievable rigor (not an ideal one warranting the Truth), suggests “let’s settle for what philosophers uphold as criteria for objectivity – coherence, correspondence, and consensus. Scientists look to independent discovery of the same phenomena.” The latter provides the standard of consensus in the

² In the informal and yet unpublished short article mentioned above, Jeremy Horne provides a very brief historical account of “Inter-Disciplinary Communication” in order to identify what rigor is or should be, in the context of inter-disciplinary communication. He provides analogies and metaphors to express why inter-disciplinary communication is a necessary condition for achieving a real rigor.

experimental sciences. But more generally, are we talking here about John Locke's Consensual Truth, as C. West Churchman called it? (Churchman, 1971). If so, then let us add Singer-Churchman's Pragmatic Teleological Truth, which is based on means-end logic (next paragraph). As long as we comply with further rational rules and restrictions, we will have a higher level of rigor, by definition of intellectual rigor. Hence, if we add to experimental methodological rules and to inductive logic restriction, the means-end logic, then we certainly would be increasing the rigor level of our thinking and, hence, the rigor of our communication. If, on the other hand, the initial artifact belongs in whole or in part, not to the experimental sciences, but (say) to the formal sciences, then the standards of those disciplines (for example, formal proof) will have to be considered instead of or in addition to experimental replication.]

Consequently, if we add the restriction of complying with Singer-Churchman's pragmatic-teleological truth (Churchman, 1971), i.e., the Means-End Logic (e.g., achieve a goal, objective, or purpose) to the disciplinary rigor, what we get is more, not less, intellectual rigor. This will get clear in the below listed Situation C, of interdisciplinary situation, where after, and only after, disciplinary rigor had been judged via disciplinary peer review, then, and only then, an additional rigor (restriction, rule) is added. This additional restriction or rigor is to comply with the Means-End Logic or the Singer-Churchman's Pragmatic-Teleological Truth of the Systems Approach (Churchman, 1971). This will have an additional review from researchers, scholars or professionals from other disciplines.

It is our understanding that interdisciplinary communication is produced, in at least the following situations:

A. **Interdisciplinary research** via **multi-** or **cross-disciplinary** teams, where multi-disciplinarity is understood as informal juxtaposition of insights from two or more disciplines and cross-disciplinarity includes some level of knowledge integration among two or more disciplines. This requires a minimum of **common** knowledge in order to **communicate** team. We would like to suggest that multidisciplinary team are related via insights and opinions (Doxa) while cross-disciplinary teams are also related via knowledge (Episteme)

B. **Transdisciplinary topics** or conceptual structures.

C. **Translating**³ (partial or total re-writing) of peer reviewed **intra-disciplinary** research and communication with the objective of interdisciplinary communication.

A case combining modes A and C can occur when the underlying research is already effectively interdisciplinary, but the exposition is placed entirely within a disciplinary framework. In essence, it then involves reversing the process of placing it in a disciplinary context, while preserving the results and insights that arose while doing so, while paying full and due attention to the interaction with other fields that may have been neglected.

³ We are using the term "translation" in its general sense or meaning, which will be briefly described below, i.e. in its meaning of translating between two Semiotic Systems, not necessarily between two natural languages which are a special case of two semiotic systems. Meanwhile, let us understand the term as an expressive metaphor referring to translation between two natural, or non-disciplinary, languages.

Situation A requires disciplinary rigor **AND** the rigor of strictly solving the problem for which the team was formed. This problem may be a technological, methodological or organizational innovation, a health issue, an effective medical diagnosis and remediation, a solution of a socio-political problem, etc. The best real-life test in meeting the additional rigor, beside the intra-disciplinary rigor, is the solution of the problem which can be observed by any peer and even non-peers. Consequently, effective multi- or cross-disciplinary teams are more rigorous. The rigorousness of their interdisciplinary communication can be observed, verified and validated by peers and, eventually, by non-peers.

Situation B requires *general disciplines* as, for example, Cybernetics, System Approach, Philosophy, Mathematics, Logic, Design, critical thinking, etc. and *meta-disciplinary approaches* as, for example, meta-science, meta-engineering, meta-research, meta-design, meta-education, meta-philosophy, meta-logic, meta-history, etc. Consequently, the intellectual rigor in situation B is the rigor associated to the respective discipline or meta-discipline.

Situation C requires both the disciplinary rigor verified by known and much used peer-reviewing processes **AND** another layer of rigorousness; which is to be restricted to what is **common** to different disciplines; which is, usually, an adequate use of the natural language and qualitative thinking. Both things *do not lower the rigor, but increase it. Disciplinary rigor should not be confused with disciplinary precision.* Using natural language may lower the level of disciplinary precision, but not be an excuse to lower the disciplinary rigor. The author of an article based on an intra-disciplinary communication should interpret and translate it into a more common language, which *might be less precise but not less rigorous.* More precision may include referring 1) to an article written for intra-disciplinary communication for those readers who are interested in more precision and/or 2) to appendixes attached to the same article and/or 3) to footnotes. Frequently, to interpret and translate intra- to inter-disciplinary knowledge requires comprehension, and not just understanding, of intra-disciplinary knowledge. Who is better than the intra-disciplinary article's author to interpret and translate such a paper with the objective of making it accessible to other disciplinarians? Notice, please, that this adds another layer of rigorousness which is to be **ALSO** restricted to the means-end logic without violating the respective disciplinary logic(s). This requires an additional mental effort and an additional creativity potential. This brings to mind a Charles Mingus' famous phrase "*Making the simple complicated is commonplace; making the complicated simple, awesomely simple, that's creativity.*" Intra-disciplinary precision is frequently achieved with the cost of increasing complexity in what is being described in an intra-disciplinary communication. This is, in our opinion, a **necessary condition** for disciplinary scientific and technological advancement, but it is not a **sufficient condition** for relating disciplines, i.e. for any kind of knowledge integration required 1) for the partial integration needed for a specific real life problem solving or 2) for a more general integration required by the advancement of human beings as human beings.

To finish this very short article, let us use the words of Julie Thompson Klein (1990). Referencing (Schneider, 1977), she affirms that "excellence is not to be measured in terms of disciplinary originality but, instead three criteria [mentioned above] that acknowledge the importance of disciplinary accuracy while allowing the *creation of new meaning*: disciplinary clarity, the clarity of cross-disciplinary communications and the combination of the existing knowledge to help solve a problem or to raise or advance knowledge a new issue ... Ultimately,

then, the [inter-disciplinary communication] depend on the quality of both disciplinary and interdisciplinary communication, on a fuller reciprocity of “text” and translator” (Thompson Klein, 1990, p. 94). [Italics added]

In some cases, particularly in Situation B disciplines (to which we would add much of Computer Science and some aspects of Data Science, there is the possibility of significant knowledge that is inherently intradisciplinary, even if it has interdisciplinary ramifications. The results of Goedel, Turing, and other impossibility theorems obviously don't solve problems--in fact, they constrain the set of problems that can be problems that can be solved. And they are necessarily posed and demonstrated within the discipline.

This is what we are trying to achieve by means of the above-mentioned situations, especially, but not uniquely, situation C, with the purpose of working out the initial steps with which we are planning to continue fostering interdisciplinary communication. For 23 years we have been trying to foster this kind of communication via conferences in which we tried to integrate traditional intra-disciplinary with inter-disciplinary presentations.⁴ The later have, mainly, been done via *verbal* communications at plenary and conversational sessions, as well as via interdisciplinary workshops and participative panels, the first day of the conference. In this new phase we are trying to foster *written* interdisciplinary communication.

Translation Between Two Different Semiotic Systems:

We frequently used, above, the word “translation”. We are providing, in this section, a very short description of the specific meaning in which we are using this term. A more detailed description would require a complete paper by its own, which is planned for the near future.

Disciplinary communication is based on what we might call Disciplinary Semiotic Systems with their own Syntactics, Semantics, and Pragmatics. Probably, a good example is one of the aspects of Semiotic Translation in Mathematics Education. Presmeg et. al. (Semiotics in Mathematics Education, 2016), for example, affirms that one of these dimensions “*is the relationship among sign systems (e.g., natural language, diagrams, pictorial and alphanumeric systems) and the **translation** between sign systems in mathematics thinking and learning.*” (Presmeg, Radford, Roth, & Kadunz, 2016, p. 26) [Italics and emphasis added]. The other dimensions of Mathematics Education apply as well, but for the sake of simplicity and the brevity required in this article, let us just mention this dimension as an example of “*translation*” between semiotic systems, which is the sense in which we used the word above. This example in mathematics applies to any discipline or disciplinary research to be delivered, orally or via written material, for inter-disciplinary communication with a multi-disciplinary audience or readerships.

In the context of the mentioned dimension of Semiotics of Mathematics Education, any communication of a disciplinary research oriented to a multi-disciplinary audience is an educational process, where academics and researchers from one discipline are teaching

⁴ More details regarding this issue has been posted at (Integrating Different Conceptions of the Notion of Conference, 2015).

academics/researcher/professionals in other disciplines. Academics from a discipline are informing academics from others, as Robert Hammond would say, (Experts Informing Experts, 2017), and often themselves learning through the effort of making the translation. Consequently, inter-disciplinary communication processes, in face-to-face or virtual groups, are necessarily collaborative educational processes; which, in turn, are among the main means of meta-education, i.e., education in real educational processes where education is not reduced to one of its means, as it is the case, for example, of instruction.⁵ An adequate education necessarily requires an effective translation between disciplinary and natural language semiotic systems, at the three semiotic levels: the syntactic, the semantic and the pragmatic levels. Likewise, in the translation required for inter-disciplinary Communication. Consequently, effective educators in Higher Education should be well trained to make the additional intellectual effort required to translate between disciplinary and inter-disciplinary semiotic systems.

This semiotic translation requires an additional act of creativity, which adds to the originality required by disciplinary research. *Originality requires creativity, but creativity does not necessarily require originality.* Reverse Engineering is one of the many examples of a high degree of creativity with no originality because it does not originate new products. Interpretations of scientific experiments require creativity but not necessarily originality, unless they end up in a new experiment that leads to new knowledge. Translation between semiotic systems necessarily requires understanding in a Semiotic System A, in order to make the intellectual interpretation required for a semiotic construction in the semiotic system B. Both interpretation and construction are creative acts. Consequently, *an author whose disciplinary article has already been peer reviewed in the respective discipline requires an additional creative act to translate it for inter-disciplinary communication.* This means that this article is both: 1) more rigorous, because of what we explained above and 2) more creative when it is delivered for inter-disciplinary communication.

More rarely, the translation and the creativity may occur in the other direction. It may be useful or interesting to translate and generalize results of an article in one discipline or even from an interdisciplinary project using a general discipline (Situation B) into the idiom of that general discipline. For example, social science research may use graph theory to model relationships, so in a sense already be interdisciplinary, and observed properties of those models might generalize to interesting (and rigorous) mathematical results.

Consequently, why this kind of articles should not be appreciated in the promotional academic systems? Why is it that “Interdisciplinary work is often attacked for lacking rigor” as Julie Thompson Klein (1990) affirms? Does not this unjustified academic belief increase the probability of intra-disciplinary inbreeding and other forms of academic incest? Isn’t that worse than the called academic incest when a student takes his/her undergraduate degree, Master and PhD at the same university? Isn’t that worse that the called academic incest when a PhD holder teaches in the same university or department in which he/she earned his/her PhD? This topic requires another article oriented to desirable and, even, necessary (in some situations) of

⁵ A detailed differentiation between Higher Education and Higher Instruction has been posted at (Callaos N. , Higher Education or Higher instruction?, 2015)

*cybernetic relationships between disciplinary and inter-disciplinary*⁶ Some of these cybernetic loops are co-regulative (via negative feedback or feed-forward) and co-amplificatory and, hence, synergistic loops (via positive feedback).

References

Callaos, N. (2017). Analogical Thinking, Inter-disciplinary Communication, and Case Studies. International Institute of Informatics and Systemics, Orlando.

Callaos, N., & Callaos, B. (2015). Integrating Different Conceptions of the Notion of Conference. Orlando: International Institute of Informatics and Systemics.

Callaos, N., & Horne, J. (2013). Interdisciplinary Communication. (N. Callaos, Ed.) Journal of Systemics, Cybernetics, and Informatics, 11 (9), 23-31.

Churchman, C. W. (1971). The Design of Enquiring Systems: Basic Concepts of Systems and Organization. New York: Basic Books, Inc. Pub.

Hammond, R. (2017). Experts Informing Experts. (N. Callaos, Ed.) Journal of Systemics, Cybernetics and Informatics, 15 (5), 31-35.

Humboldt, Wilhelm von, 1836. On Language. The Diversity of Human Language-Structure and its Influence on the mental Development of mankind. (tr.) P. Heath. Cambridge: Cambridge University press. (1988 edn.)

Presmeg, N., Radford, L., Roth, W.-M., & Kadunz, G. (2016). Semiotics in Mathematics Education (1st ed.). Springer (ICME-13 Topical Surveys).

⁶ A related work is in progress. An unfinished and unedited article with regards to intra-disciplinary incest and the cybernetics loops that would avoid it can be solicited to the first author of this article.