On the Criticality of Interdisciplinary Communications for Continued Scholarly Research, and the Potential Applicability of the Case Studies Methodology

Reflection Paper

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ABSTRACT

Increasing the prevalence and effectiveness of interdisciplinary communication/collaboration is not a simple matter, but has significant benefits to offer. Ironically, one of the greatest challenges, namely the diversity in perspectives and contributor nature, provides one of its most significant payoffs. Diversity in backgrounds, skills, knowledge, and approaches promotes ingenuity and creativity, and is a powerful source of innovation. But perhaps more importantly, effective interdisciplinary collaboration is essential for applying forefront research to the most challenging societal problems.

This reflection paper describes a line of reasoning for why effective interdisciplinary collaboration skills have emerged as an essential, and yet largely neglected, requirement for maintaining the development and relevance of scholarly research. It outlines challenges that must be overcome in meeting this requirement, important factors for addressing those challenges, and concludes by discussing the applicability of the case methodology, as introduced at the 2014 International Multi-Conference on Complexity, Informatics and Cybernetics, as a mechanism for training people to become effective participants in interdisciplinary endeavors.

INTRODUCTION: INTERDISCIPLINARY EFFECTIVENESS – AN UNAVOIDABLE FRONTIER

A mere few hundred years ago the landscape of scholarly investigation differed substantively from today's research arena. The research workforce comprised a comparatively small core of dedicated, and typically self-sufficient, intelligentsia undertaking studies directed primarily by their broad-ranging personal interests and curiosities. Most of the "A-list" researchers were able to remain aware of, if not directly leverage and influence, the activities and discoveries of their peers. They might not have described themselves as "multi-disciplinary", as there was no pressing need to draw explicit delineations between individual disciplines, but the essence of research was to make contributions to, and to take advantage of, a holistic body of human knowledge and understanding.

While the past few centuries may be brief on a timeline of human history, the exponential nature of population and knowledge expansion make it a distant past when viewed down the axes of investment and growth, and those intervening ages have witnessed a distinct shift in the nature of scholarly investigation. Today it is essentially impossible for a single person to be well-versed in a holistic body of human knowledge. New discoveries emerge with such rapidity that even the fastest reader cannot keep pace with publications in a large single discipline, much less across multiple fields.

This transition to a discipline-based structure of research has enabled us to continue expanding the knowledge envelope, but has simultaneously introduced a disjunction between product and purpose. While we continue to expand understanding with comparatively minor impedance resulting from this hyper-specialization, the majority of challenging, naturally-occurring problems (i.e. the problems that exist and challenge us in and of themselves as opposed to domain-specific, academic questions arising primarily from intellectual curiosity) remain interdisciplinary in nature. In other words, while our problem-solving toolset has become reductionistic by necessity, our biggest, most critical challenges demand holistic solutions.

As a consequence of this evolution of the scholarly landscape, we face now the challenge of effective knowledge integration on a large scale. What early intelligentsia could address through personal dedication and thoroughness, we must overcome through effectiveness in tailored interdisciplinary collaboration. The purpose of this paper is to reflect upon the critical (and sometimes uncomfortable) challenges that must be faced in training the development of interdisciplinary effectiveness, and is concluded by outlining a mechanism, inspired through discussions held at the 2014 International Multi-Conference on Complexity, Informatics and Cybernetics (IMCIC 2014), that could

serve as one of many tools for contributing to a comprehensive solution.

THE CHALLENGES: LINING UP THE USUAL SUSPECTS

Effective interdisciplinary collaboration requires creativity and informed reasoning to build appropriate connections between different fields of expertise. While this is not a trivial demand in and of itself, it is often dwarfed by the challenge of establishing effective communication between experts in different domains. Where the effectiveness of the former can typically be estimated or measured outright, formulaic mechanisms do not exist to determine whether effective communication has occurred; most often, failure to communicate is only discovered standing over the metaphorical debris from the collision of multiple trains of thought that were not, as it turned out, heading in the same direction after all.

The difficulty in establishing effective communication is not surprising, and is the result of numerous factors. Humans' use of language is contextual, and the interpretation of words is generally subconscious – unless great care is taken to make it deliberate. Even though people may speak the same "language" in the sense of using a common grammatical structure and recognized vocabulary, there can be no guarantee that what is spoken is identical in precise meaning, inference, and consequence as that which is heard. In fact, it can be argued from a logical perspective that because no two people share identical experience bases, perfect communication is essentially impossible for non-trivial topics (but fortunately *effective* communication is more approachable). That this phenomenon appears so frequently as a theme in movies, books, television, etc. is an indicator of the ubiquity of the experience of miscommunication.

Fields of scholarly pursuit establish their own tailored vocabularies in order to support efficient "internal" discourse on important topics, and learning this vocabulary – perhaps one of the most valuable outcomes of a graduate school experience – takes an investment of time, an understanding of context, and a deep appreciation of the domain. Learning more than one domain has traditionally happened only serendipitously, namely when someone just happens to be sufficiently interested in both to warrant the dual investment. While there are certainly individuals who have developed a talent at quickly "picking up local lingos" and are capable of serving as a translator between two fields, this author is not familiar with any program of formal training designed to teach people how to quickly and effectively learn the necessary context and linguistic idiosyncrasies of a domain (i.e. without following the "full immersion" path). Lacking such training, as well as recognition of its value within research communities, we are fundamentally limited in the extent and effectiveness with which we will be able to carry out interdisciplinary work. There are simply not enough "multi-hatted" facilitators out there.

The complexity of domain-specific concepts is not the only reason why learning a field's language can be difficult. Many professionals have come to use their domain's language as a form of "testing ground", a means by which to identify others who have made similar levels of investment as themselves. The domain expert eventually comes to use sophisticated, often obfuscating, terminology as a matter of habit, even when an idea could be explained simply using more common phrases. In effect, there can arise in some experts an elitist attitude, even a desire to make one's own field sound more impressive with the aim of cultivating respect or awe in others. Unfortunately, this often engenders an "us versus them" mindset, making interdisciplinary communication that much more challenging.

A last practical challenge worth noting is that the use of tailored language is a human norm. We use language as we do because it provides us with an efficient means for capturing and expressing concepts, enabling us to manage "large" quantities of complex ideas easily. When we are forced to rely upon verbosity for precision, we find it slow and painful, and the mind is inclined to conveniently forget that everyone else does not share its own "common" knowledge, perspectives, and contexts. As an example, it is common for even experienced public speakers to fail to notice their own use of acronyms during a presentation. The mind does not process or utilize language on a word-by-word basis, and attempting to do so is not a trivial undertaking. Exacerbated by the ever increasing pressure to "do more faster" (and with fewer resources), any solution that even hints at – much less requires – slowing down a little will find itself disadvantaged.

THE SOLUTIONS: ADDRESSING THE CHALLENGES

Breaking interdisciplinary barriers begins with mutual respect. While this sounds obvious, or perhaps even trivial, it is often a significant hurdle. After making a multi-year, if not life-long, investment in a particular domain, that vested interest can easily impact one's perspective of the relative value of other fields. Even at the undergraduate level, it is not uncommon to hear students suggesting that other areas of study are "not real majors" or that their classmates in those majors are not as smart, dedicated, capable, etc. Most people would agree, at least when discussing the matter abstractly over a cup of tea, that cognitive capacities are non-transitive by nature, but this is something easily forgotten in practice. Recognition that intelligence is not a one-size-fits-all linear metric become especially difficult to retain when

multiple researchers are competing for a limit pool of research funds.

Engendering respect is neither fast nor easy. Respect for something or someone results from a body of experiences that lead one to conclude that there is sufficient value to be found against the cost of "excavating" that value. As such, a natural first step is to arrange for circumstances optimized for recognizing the value that others can bring to the table; further, one must continue to do so over an extended period of time in order to repeatedly emphasize the point. It is proposed, then, that a process for building interdisciplinary collaboration should 1) *ensure that differing domains are easily recognizable as having valuable information and skillsets to offer*, and 2) *involve repeated experiences in which those values are apparent*. These two points are important but not sufficient to provide an effective interdisciplinary collaboration training experience, and additional factors will be added in the following paragraphs.

Because bridging a discipline gap is not a natural inclination, it is unlikely to occur spontaneously for most people. Consequently, building an interdisciplinary capability/skill set will require a clearly-identified, and ideally mandatory, purpose as motivation. To be most effective, this purpose should be structured around a specific, concrete problem or challenge that can serve as a focal point for activities and provide tangible success indicators, preferably ones that support metrics highlighting the benefit of interdisciplinary collaboration. Towards this end, the best challenge would be one for which a single discipline is incapable of providing an acceptable solution. At the same time, the problem must be sufficiently complex that contributors do not feel like they are being scripted towards an obvious final solution, i.e. there should be a spectrum of approaches through which the nature and specific strengths of individual participants impact potential solutions. In short, an interdisciplinary communications training activity should have additional solution-space factors of: 3) *providing a shared context with a commonly understood, interdisciplinary problem to be addressed*, where 4) *the problem itself is sufficiently complex that the generated solutions are clearly dependent upon the individual contributors*. Further, 5) *the problem should support multiple viable solutions*, and 6) *have clearly definable measures of goodness to support the ranking of solution quality against the effectiveness of interdisciplinary collaboration*.

There are other considerations that are generically applicable to cultivating an effective communications skill development environment, whether interdisciplinary or otherwise. When groups of people interact, differences in personalities and communication styles can, if left unmediated, result in a less than ideal exchange. To avoid having a subset dominate an interaction, one should aim to 7) *provide a moderated environment with clear rules and expectations to ensure effective and balanced contributions from all participants*. In addition, the best learning and skill development will happen when participants are comfortable and have a clear understanding of expectations. Consequently, one should also strive to 8) *establish a safe environment in which participants have a chance to practice contributing, and preferably are already familiar with the rest of the contributors*.

SUMMARY: AN OPPORTUNITY TO LEVERAGE THE CASE STUDY METHODOLOGY

During the IMCIC 2014, Professor Gill gave a presentation on Case Studies and Methodologies in which he described a process where students were introduced to complex, challenging situations, and trained through a series of activities to use critical thinking to provide useful analyses and recommendations on these situations. Some of the key features of the described method were the selection of an appropriate real-world situation with sufficient complexity that there was not an apparent "right answer"; the extensive collection of context-establishing facts to serve as the basis for discussions and analyses; a well-defined process to prepare students to engage effectively in those discussions/analyses; and a proven mechanism for assessing the extent and quality of contributions made by the participants.

Within that context, consider the list of eight factors that were highlighted in the previous section. Specifically, in developing a system/process for training effective interdisciplinary communication one should:

1) Ensure that differing domains are easily recognizable as having valuable information and skill sets to offer.
2) Involve repeated experiences in which the value of interdisciplinary collaboration is apparent.
3) Provide a shared context with a commonly understood, interdisciplinary problem to be addressed.
4) Use a problem sufficiently complex that the generated solutions are clearly dependent upon the individual contributors.
5) Identify a problem that supports multiple viable solutions.
6) Have clearly definable measures of goodness to support the ranking of solution quality against the effectiveness of interdisciplinary collaboration.
7) Provide a moderated environment with clear rules and expectations to ensure effective and balanced contributions from all participants.
8) Establish a safe environment in which participants have a chance to practice contributing, and preferably are already familiar with the rest of the contributors.

While the original context of the case methodology focused on analysis of business-specific problems, with some slight modifications the same approach could meet

many, if not all, of these eight needs, and hence serve as a valuable tool for training effectiveness in interdisciplinary communications.

A logical starting point for making these adaptations would be the identification of a suitably interdisciplinary problem to address. Specifically, the problem would be one where the information and approaches specific to individual disciplines can be divided amongst different participants, and where a suboptimal outcome would result in the absence of effective communication amongst everyone. Problems of this nature are certainly plentiful, although finding simple, approachable ones would require careful consideration. For example, although cyber security is a fundamentally interdisciplinary topic – balancing monetary and societal risks against financial constraints, technical feasibility, human behavior, corporate drivers, etc. – it might not represent an ideal context for training purposes due to its extreme complexity (and seeming intractability).

In addition to dividing the relevant case facts among the various participants from different fields, a distributed scoring system that emphasizes the value of collaborative solutions could also be advantageous. For example, a non-linear system that results in better scores for cohesive solutions, as well as substantially penalized scores for solutions that disregard inputs/drivers/ requirements from one or more areas, could provide encouragement to ensure that sufficient effort is placed on understanding and meeting the needs of each individual discipline.

It is beyond the scope of this reflection paper to provide a detailed plan for developing a curriculum for training effective interdisciplinary communication, but hopefully the lines of thinking presented herein are compelling for anticipating that the case studies methodology would serve as an effective foundation for such an activity.