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INTRODUCTION TO THE SPECIAL SECTION: INTERDISCIPLINARY COLLABORATION

Multi-Level Perspectives on Interdisciplinary Cognition and Team Collaboration: Challenges and Opportunities

by

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A few years ago, when three past presidents of the Association for Interdisciplinary Studies (AIS) were invited to offer their views on the State of the Field in the 2013 volume of *Issues in Interdisciplinary Studies*, they all emphasized the increasing importance of collaboration or teamwork in interdisciplinary studies (Klein, 2013; Newell, 2013; Szostak, 2013). From its inception in 1979, AIS had been mainly concerned with the teaching of interdisciplinary studies, and its primary focus had long been on the individual researcher's task of integrating multiple disciplinary perspectives on a complex phenomenon. However, with the new need for collaborative competencies in research as well as in (under-)graduate education, AIS interest in fostering interdisciplinary studies had expanded to include those competencies. Since then AIS, in tandem with kindred organizations that have emerged over the last decade – like transdisciplinary-net (*td-net*), Integration and Implementation Studies, and the Science of Team Science (*SciTS*) – has promoted work on interdisciplinary research collaboration. New questions have emerged, like how interdisciplinary work must be

understood once it is no longer taking place within an individual's skull; how psychological and social processes enable such understanding to arise or impede its doing so; how both individual and team performance can be fostered; how the most can be made of the diversity associated with an interdisciplinary team; and so on.

At first glance, individuals working as members of teams would seem to have an advantage over those working alone—an advantage related to the amount of diverse expertise the individual scholar must possess in order to pursue genuinely interdisciplinary inquiry. One of the main challenges for individuals planning to embark on an interdisciplinary research project is to develop, in addition to their disciplinary or specialist expertise, what has been called “adequacy” in another discipline (or disciplines), “an understanding of each relevant discipline’s cognitive map sufficient to identify its perspective on the problem, epistemology, assumptions, concepts, theories, and methods in order to understand its insights concerning the problem” (Repko & Szostak, 2017, p. 146). Following the logic of the cognitive map metaphor, interdisciplinary work carried out by an individual involves combining various cognitive maps with each other, compiling the information gathered in these maps, and drawing connections among them.

However, identifying which disciplinary approaches (and maps) are relevant to the problem at hand and which not depends upon preceding insights into the variety of disciplinary contents deemed relevant to the problem. This clearly can present a formidable challenge. In addition, even within a single discipline theoretical and methodological pluralism can present difficulties (Miller, et al., 2008). Navigating all this pluralism is hard for individual researchers. Yet while it may be less hard when individuals are members of teams in which contributions from the various relevant disciplines will be distributed across team members who need only have expertise in their home disciplines, that very advantage entails a disadvantage, another kind of challenge.

How so? When the metaphor of the cognitive map is applied in this context of interdisciplinary collaboration, it reveals the difficulties. If individual team members are developing cognitive maps separately, what does it take for them to mutually communicate and understand the maps of one another so they can then coordinate a team project aimed at further integrating and developing these maps into a more comprehensive interdisciplinary map – or representation, or model, or other integrative device? To what extent is the potential advantage of being less taxed individually with the need to develop adequacy in other disciplines than one’s own offset by being burdened more with the requirements of communication, coordination, and mutual understanding in the team context?

This Special Section of *Issues in Interdisciplinary Studies* contains three articles each of which brings insights, in particular from psychological

science, to bear on the challenges and opportunities that characterize both individual and collaborative interdisciplinary work. Psychology and its kindred disciplines – like the cognitive sciences – form an important source of insights for understanding and fostering the interdisciplinary process – both in education and in research. Psychologists from different subdisciplines have focused on distinct levels of processing: on the micro-level of intra-personal, the meso-level of inter-personal, and the macro-level of group or collective processing. Obviously, when focusing on any of these levels, psychologists have to take into account how they interact with and influence each other, making psychology an exemplary interdisciplinary discipline itself. In addition, by being the discipline focusing on mind and behavior, psychology also covers the roots or sources from which the interdisciplinary processing and its products stem. Since ancient times, *avant la lettre*, psychologists have studied insights, knowledge, and understanding as the results of various intra-personal and inter-personal or social processes like perception, reasoning, communication, and collaboration. These reasons explain why this Special Section presents analyses of interdisciplinary understanding and of interdisciplinary collaboration that employ psychological and cognitive (neuro-scientific) insights, aiming to understand and facilitate these processes as well.¹

Given this tight connection between psychology and the interdisciplinary process, Frank Kessel and Machiel Keestra decided to organize a panel session about this connection at the March 2015 meeting of the International Convention of Psychological Science (ICPS) in Amsterdam. Together with colleagues with expertise in different interdisciplinary and transdisciplinary methodologies, they proposed a session about how these methodologies would be useful for colleagues from psychology. It was titled “Theoretical and Methodological Contributions of Inter/Trans-Disciplinarity (ID/TD) to Successful Integrative Psychological Science.” All contributions also employed psychological insights to shed light on the intra-personal or inter-personal challenges implied in these methodologies. The panel session was comprised of presentations by Hans Dieleman, Machiel Keestra, Frank Kessel, and Michael O’Rourke, the first two of which have resulted in the first two articles contained in this Special Section of *Issues in Interdisciplinary Studies*.

¹ Not surprisingly perhaps, the concept of “interdisciplinary” research was introduced at the Social Science Research Council around 1925 when it aimed to mitigate increased specialization and isolation of disciplines through funding projects that originated in at least two of its member societies (Frank, 1988). Margaret Mead’s cultural anthropological research into socio-cultural influences on human psychology on New Guinea was one of those projects, being interdisciplinary in nature yet not carried out by an interdisciplinary team (Mead, 1930).

The third article here – by Whitney Lash-Marshall, et al. – was chosen for inclusion because the authors’ analysis and approach well complement those of the other two. Before introducing these three articles, I will briefly describe the Amsterdam presentations by Frank Kessel and Michael O’Rourke, who weren’t able to turn their presentations into articles for this Special Section.

Frank Kessel (University of New Mexico) introduced the session with a brief overview of recent developments in the fields of interdisciplinarity and transdisciplinarity that show their growing relevance. This is demonstrated by increasing interest in cross-disciplinary collaborations in the health and social sciences (Kessel & Rosenfield, 2008). The transdisciplinary research process in particular involves special challenges since it entails the integration of extra-academic participants who bring their experiential knowledge, and norms, and values to the table. This expansion of research teams to include community stakeholders adds obstacles to those inherent in collaboration among academics from different disciplines, making it even harder for such research projects to succeed, asking in some cases for institutional adjustments in order for the projects to reach more robust results (Foster, 1987). Kessel discussed both internal and external conditions that can impede collaborations or facilitate them: internal conditions like discourse barriers or serendipitous encounters across disciplines, and external conditions like discouraging hiring policies or encouraging funding programs. Conceptually facilitating interdisciplinary and transdisciplinary research is the recognition that in the domains of life and social sciences we are usually looking not at hierarchically structured phenomena but at heterarchically structured ones. Hierarchical structures may seem to ask for reductionist accounts that in turn influence the relations among participating disciplines, some of which appear more fundamental than others. In contrast, heterarchical structures allow for dynamical changes of the relations among elements and the levels at which they figure, as when a unit at a lower level has in some contexts a larger influence than units at otherwise higher levels. A consequence is that factors such as culture and history can have an unexpectedly large impact upon the phenomena studied in psychological science, making collaboration among people in many disciplines advisable and indeed inevitable.

Michael O’Rourke (Michigan State University) contributed to the Amsterdam session with a presentation on “Philosophical Technology and Transdisciplinary Integration: Adapting to Climate Change in West Michigan.” As he explained, problems such as the effects of climate change in particular areas require collaboration among academics in multiple disciplines as well as the integration of people representing other sectors of society in the processes of research and decision-making. Lacking a shared

research background, participants must work together in order to develop their integrative capacity. An important way to develop a group's integrative capacity is by involving everyone in building a common conceptual framework. Needed is a process that allows all relevant stakeholders to participate and respectfully engage with each other, i.e. a form of dialogue. Optimally, such a process should allow the assessment of the process' quality, while recognizing that changing conditions and priorities may make it necessary to repeat the dialogue process. Presenting a questionnaire and examples of the dialogue it facilitated (elements the Toolbox Project provided those involved in the West Michigan undertaking), O'Rourke discussed how philosophy could help to enhance mutual understanding via the shared reflection on assumptions about knowledge, values, and priorities that participants always make (O'Rourke & Crowley, 2013). Such reflection allows participants to scrutinize relevant mental models, these being the representations of how they think about a particular domain that are partly informed by their values and norms. These value-informed mental models form part of the input for the facilitated dialogue that subsequently contributes to the group's growing integrative capacity. In other words, the Toolbox Project process combines insights and methods from psychology and philosophy in order to support the problem-solving capacity of a group engaged in collaborative interdisciplinary or transdisciplinary work.

Here in this Special Section as earlier in Amsterdam, Machiel Keestra's presentation deals with the implications of the fact that interdisciplinary understanding can be the goal of an individual scholar informed by multiple disciplines but also of a team, consisting of members from different disciplines. Particularly complex, dynamic phenomena require the theoretical and methodological pluralism implied in such interdisciplinarity, with each approach having only a limited relevance and many approaches being necessary for maximum relevance. This raises the question, though, how subsequent integration of so many insights is actually possible and how it can be facilitated. Providing answers to both the descriptive and the prescriptive questions, Keestra focuses first on the micro-level of intra-personal processing, discussing the mental representations that are employed in most cognitive and behavioral processes. Experts differ from beginners as experts have assembled and memorized during thousands of hours a huge number of structured mental representations that facilitate their perception, recognition, understanding of, and responses to phenomena in their field. Experts need not be aware of these mental representations and the cognitive processes in which they are employed, since much of our cognition and behavior occurs automatically and implicitly. Yet such automatic and implicit cognition is usually not sufficient

for interdisciplinary understanding. On the contrary, Keestra argues how important metacognitive knowledge and skills are to facilitate interdisciplinary understanding as metacognition enables experts to monitor and regulate their cognition and representations, overcoming thereby some of the obstacles facing interdisciplinary understanding. Metacognition should be added to the process of philosophical reflection – which was O’Rourke’s presentation topic – as both in their own way make experts realize how their thinking and understanding may differ from those of others. Moreover, metacognition prepares experts for such reflection and for interdisciplinary engagements more generally. In the second section of the article he explains how metacognition also occurs (and must occur) at the macro-level, when interdisciplinary team members are together collaborating and seeking integration of their insights. In such cases, team members are also forming “team mental representations” that comprise information about the team’s members, tasks, process, and goals. Obviously, if members hold team mental representations that are inconsistent, the inconsistency creates a formidable obstacle to the successful practice of interdisciplinarity. Team metacognition helps to avoid such obstacles. In his concluding remarks, Keestra briefly comments upon Reflective Equilibrium as a third process that facilitates interdisciplinarity, in addition to metacognition and philosophical reflection.

Next in this Special Section focusing on both the micro- and the meso-level of interpersonal understanding, Dieleman offers a description of the method of “transdisciplinary hermeneutics,” developed so as to invite individuals to employ multiple sources of personal experience and knowledge such that their creativity is optimally released. Starting from the theoretical work of quantum physicist and founder of the *Centre International de Recherches et Études Transdisciplinaires (CIRET)*, Basarab Nicolescu, Dieleman explains how the plastic and discontinuous nature of reality makes it almost impossible to capture reality with the limited forms of knowledge normally activated in transdisciplinary projects, yet at the same time does allow us to creatively modify or change reality. Taking a critical stance towards the more traditional scientific approach to reality, with its emphasis on rational and quantitative explanations of its material properties, Dieleman refers approvingly to recent insights from cognitive neuroscience about the affective and embodied nature of our cognition. What implications should these insights into the nature and sources of our knowledge and understanding have for the interdisciplinary process? And how are these implications connected to the creativity that we time and time again demonstrate in our engagement with reality? Dieleman describes two “competencies of transdisciplinary hermeneutics” that can be developed in order to more deeply and fully put our rich sources of knowledge

and understanding to use. These competencies are mindfulness and transdisciplinary dialogues of knowledges. Both are not commonly applied during the interdisciplinary process, yet the article suggests how they can help us address some of the barriers and limitations that this process is usually subject to. Employing the process in an enriched form with the addition of these competencies, individuals and groups engaged in “transdisciplinary hermeneutics” can find a way to combine their heads, hearts, and hands in bringing their projects to satisfactory conclusions.

After attending to how metacognition and philosophical reflection bolster the development of expertise in individuals and interdisciplinary teams in Keestra’s article and Dieleman’s subsequent exposition of the transdisciplinary competencies implied in the method of transdisciplinary hermeneutics, this Special Section closes with a contribution focusing on the macro-level of an interdisciplinary team and its institutional context. Lash-Marshall, Nomura, Eck, and Hirsch start by looking more closely at the barriers that teams face when embarking upon an interdisciplinary or transdisciplinary process, barriers that range from lack of funding to lack of shared language or location. Based upon a survey they conducted and close investigation of actual collaborations among colleagues from different disciplines working with extra-academic participants, they identified trust as a fundamental issue that needs to be addressed. If a team is not successful in creating trust, the intersubjective or team cognition that should be the result of their interdisciplinary process might not even start to develop and other barriers might well remain insurmountable. Reading the practical strategies proposed in this article against the background of the investigations of the cognitive processes occurring at the micro- and meso-levels in the preceding articles, it’s clear the points made here complement the points made earlier. Summing them up, the four strategies are (1) pairing team leaders with external facilitators; (2) identifying barriers to fruitful collaboration; (3) writing “strategic operating agreements”; and (4) developing collaborative visualizations of the research process. These strategies were developed and applied during the work of the authors (and colleagues from the SUNY network of universities) with representatives from industry, specifically from the Green Composite Materials group. Initial responses of the group were positive, confirming how they were able to develop shared understanding and ideas even on sensitive issues like the allocation of funding and responsibilities.

The three articles of the Special Section offer us some general psychological insights into the interdisciplinary process in combination with particular insights into the psychological conditions facilitating that process. Moreover, they all explain why this process often requires researchers to

put extra time and effort into the process, necessary to develop certain competencies and strategies to mitigate the difficulties that can hinder the interdisciplinary process for both individuals and teams. Once researchers and educators training future researchers are aware of these conditions, competencies, and strategies and how best to employ them, all involved in interdisciplinary work—and especially collaborative interdisciplinary work—will be much better able to draw in a productive and creative way from a rich diversity of perspectives and expertise for insights into and solutions of the complex problems we are facing today.

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