Disentangling the different layers of interdisciplinarity

Renate Klaassen

Abstract

Interdisciplinarity for complex problem solving is a rising phenomenon. Each self-respecting university is trying to realise different programmes and approaches to interdisciplinary teaching and research. The debate on what interdisciplinarity is, how it may work as a substantial part of a university, which barriers are encountered to realising interdisciplinary teaching and research and what the added value is, is addressed in this paper from a social science perspective. Based on the attendance of a conference at the Volkswagenstiftung organised by the Humboldt University of Berlin, different scholarly viewpoints and examples are explored on Interdisciplinary teaching and (researching). Collaborations across the at-times-fragmented subfields of research and education ultimately yield insightful, informative, and even educational experience that creates space for mutual understanding and new ways of thinking about seemingly-established approaches to knowledge-building and communication.

Keywords Scholarly communication

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Introduction

The Humboldt University established by Willem von Humboldt adopted the principles of Alexander von Humboldt: in particular free and open access of knowledge sources, inclusive discussions and knowledge creations (i.e. the ability to listen to one another, willingness to learn from one another). The university celebrated the 75th anniversary of the universities foundation, in remembrance of von Humboldt by organising a series of lectures, seminars and dances in 2019.

"Interdisciplinarity revisited" was one of the series in the Humboldt Open Forum series.

> *"Taking a closer look at different concepts and definitions of interdisciplinarity and their application in every day university practice is the aim of a symposium jointly*

organised by Humboldt-Universität zu Berlin, the foundation Stiftung Humboldt Forum im Berliner Schloss and the Volkswagen Foundation. Under the heading "Interdisciplinarity Revisited" experts from all over Europe and abroad will discuss the impact of the concept of interdisciplinarity on university education and research" [1]

Approximately 200 international scholars gathered around this theme of interdisciplinarity. The new Interdisciplinary Institute has been set up because it was felt by the Humboldt University, that without new structures, interdisciplinarity is not feasible. While interdisciplinarity has achieved a status of recognition, it has not reached its full potential due to the persistence of significant obstacles at many levels of the creation of knowledge [Wernli, Darbellay and Maes, 2017, executive summary]. The scholars and participants discussed different perspectives and conceptual reflections, supported by practical examples of what interdisciplinarity is, how it might be organised and possible obstacles in realising interdisciplinarity. This article is a reflection of the presented work and round table discussions taking place during the seminar.

Why do we need interdisciplinarity?

Currently, scientific research is driven by a surge in technological/engineering sciences as a result of enormous budgets in the defence industries of various countries in the world (van de Wende/Frodeman). Other pressing problems, like the rise of an ageing population, keeping the healthcare budgets in check, the daunting challenges faced as a result of population growth and climate change also ask for technological solutions (Hartmann). The humanities/social sciences risks to be weighted as economically less relevant, unless it is to bridge the gap between the sciences and society [Frodeman, Klein and Pacheco, 2017; Frodeman, Klein, Mitcham et al., 2007]. However, the humanities have and essential role to play in these activities, such as the provision of communication, that is key to capturing knowledge production and the dissemination of insights towards relevant fields. Facilitating and supporting the development and willingness amongst participants to learn from one another and stimulating the stakeholders to appreciate the linguistic basis of knowledge creation, as- that is the outcome of social learning. Without any form of communication between academic disciplines, disciplinary knowledge would be so fragmented that the progression of ideas and innovation would be impaired [Wernli, Darbellay and Maes, 2017]. Societal progress, therefore, requires intelligent, context-sensitive discussions where one's own and others' values are evaluated by standards of reasonable discourse [Frodeman, Klein and Pacheco, 2017; Frodeman, Klein, Mitcham et al., 2007].

At this seminar, an attempt was made to create a linguistic basis for studying or researching the construct of interdisciplinarity, to build the concept of collaborative identity and its lingua franca. In the literature, a hybrid of specialised terms is used amongst researchers to capture interdisciplinarity. Interdisciplinarity as a construct can be expressed, for example, in the level of integration of different disciplines [Repko, 2007; Menken and Keestra, 2016; Boix Mansilla, 2017]; the paradigmatic distance between disciplines [Gantogtokh and Quinlan, 2017]; an epistemic coherence of disciplines [MacLeod, 2018]; a community of scholars [Lattuca, 2002]; the level of institutionalisation and its communicative patterns [Rauchfleisch and

[1] https://www.volkswagenstiftung.de/en/events/calendar-of-events/herrenhausen-symposia/interdisciplinarity-revisited.

Schäfer, 2018]; or a problem-solving activity along the lines of specific research approaches [Lam, Walker and Hills, 2014; Klaassen, 2018]. Taking a closer look at what the concept of interdisciplinarity is, uncovering the blind spots and the contribution to everyday university practice, may help to build collaborative identity and facilitating the communication in interdisciplinary environments [Klein, 2010].

Discussions and examples of interdisciplinarity

The communication between different disciplines is driven, according to Maki, by a distinction between several aspects. First, comparing (a) closer vs. wider interdisciplinarity, based on the interpretation of Kelly [1996]. Here the values and meanings in two or more merging disciplines are closely related, such as in positivistic sciences as opposed to those disciplines where values and meaning are wider apart. The second distinction is between b) bottom-up developments vs. top-down regulations, which is addressing the organisational mechanism and fluidity of disciplines. The third aspects group of aspects are (c) autonomous innovation vs. administered and measured interdisciplinarity, that are drivers for interdisciplinarity. Finally, (d) interdisciplinarity within academia vs. inter-disciplinarity between academia and the public shows the communicative barriers; [Szöllösi-Brenig, 2019]. These distinctions will be examined sequentially below.

Wider vs. closer interdisciplinarity

Interdisciplinarity is a being "in-between disciplines" stemming, according to the speakers in the seminar, from different sources. This notion of in-between has been around for a long time. In 2000 Wissoker [2000] already noted, it is impossible to produce work that does not bear the marks of the original discipline. Perspective on "in-between" disciplines vary with different views on interdisciplinarity and in accordance with the identities and roles the speakers take in their field of operation [Kahan, 2015].

Emerging disciplines, according to Stichweh, have their source in the notion that problems have to be broken down to be solved. When the answers are not immediately found, there are "in-between" disciplinary answers, creating *conflicts* that push toward new disciplinary boundaries and specialisations. Stichweh, who studied the emergence of physics as a scientific discipline, argues that all sciences evolve into other scientific disciplines. The notion seems to be that when a phenomenological problem is too complex in nature, it needs a reduction of complexity through positivistic objectivity. This view is very much in line with the LERU position paper on interdisciplinarity [Wernli, Darbellay and Maes, 2017] where it is argued that disciplines are central to the academic system. The conflicts of Stichweh represent the questioning of possibilities and limitation of disciplinary boundaries as a critical driver for the creation of new knowledge or (inter)disciplines. The further apart the epistemology of the disciplines is, the more difficult it is to settle the conflict [Kelly, 1996]. The reframing of which phenomenal problems are solved with which particular theories, methods and approaches re-establishes the new boundaries of a discipline. Interdisciplinarity is, thus, to stimulate the reconfiguration of disciplinary boundaries and the iterative creation of new disciplines towards the progressive accumulation of knowledge.

Bottom-up revitalisation of disciplines

Carson (UC Berkely) posits that the *inter* between disciplines has always existed, new knowledge construction occurs at the boundaries where courageous researchers do important explorative work. However, without the disciplines, there is no interdisciplinarity. The disciplines are there to validate and qualify the reliability of our data. It is the training and socialisation in a discipline that validates our identification with a discipline. Interdisciplinarity is, in that case, a "space"-filling activity, a superposition of the disciplinary structure. It is not a zero-sum game, but a co-existence or duality; stimulating a process of change [Szöllösi-Brenig, 2019]. Functional realism invites the integration of two paradigmatic approaches bridging the gap(s) between different disciplines. Innovation is at the edges and challenging the system to revitalise and get the institution out of institutional hibernation.

UC Berkeley, according to Carson, recognised the interdisciplinary nature of data science at a very early stage of its development and took the initiative to create an interdisciplinary meeting ground (eventually a centre) as an addition to the disciplines. It started while embedding inferential computational data science classes into the regular curriculum (involving information science/technical applications) and showing its intertwining and relevance within different fields. Albeit slow to start up, it gained traction as the economic value became clear of data science knowledge within the disciplinary boundaries. Data Science is now embedded in all bachelor tracks serving more than 7500 students yearly and a host of other initiatives on data science, amongst ethics of data science and fast-moving to an era of quantum computing and no longer bottom-up, but as a top-down activity. A similar interdepartmental path involves Climate Change and Social Equality.

Contrary to the previous view of Stichweh, there is no re-fixation of "new" disciplinary boundaries. Disciplines and interdisciplinary are fluid notions which are employed to cater to contextual needs and address issues from different scientific perspectives [Rauchfleisch and Schäfer, 2018]. These notions are highly influenced by the socialisation (the scholarly identity) (Kahan,) and the disciplinary training of the presenter in question (Carson).

Top-down-regulation — solving societal problems

Crow, as a dean of Arizona State University (ASU), takes the notion of fluidity one step further and shares a rather pragmatic vision and approach towards interdisciplinarity. He is framing its primary purpose as solving problems for the "good" of society using one paradigm with multiple knowledge sources as input or multiple disciplines with multiple paradigms as it functionalism requires. Interdisciplinarity is a means to create outcomes for and with society, including new theories, new ideas, innovations and improved solutions for society. It is a different kind of knowledge creation that should not be followed by all according to Crow. Nonetheless, it offers a different perspective on what we consider valid knowledge creation. This interdisciplinarity is driven by the desire to use measurements of inclusion not of exclusions; create added value for society; realise it has a moral purpose and finally to assume responsibility for outcomes in our

contexts. ASU made interdisciplinarity an articulated priority, encouraged and recognised across the whole university.

Crow (ASU) provides an inspiring example of how Top-down fluidity of interdisciplinarity for societal benefits may successfully work in terms of organisation. Arizona State University decided to abolish all departments. Academic staff are the designers of the intellectual programmes in 23 thematically bounded, but loosely structured schools with names as; "school of earth and space explorations", "school of electrical computer and energy engineering". Interdisciplinarity is organised on an individual basis or collaboratively around the grand challenges of the 21st century. According to Crow, the new structure has been a disciplinary awakening attracting many entrepreneurial, creative minds scholars and students. Students numbers have risen with 17.000 students from the start of the implementation — and graduates are appointed to a job within three months of graduation. Academics are no longer in the disciplinary silo's but largely work interdisciplinary. *"We are devising new theories, methods, novel solutions uniquely additive to anything disciplinary we have had before!"*

Autonomous innovation — interdisciplinarity from the centre

In the discussion panel, a more interpretive and individualised way of approaching interdisciplinarity is forwarded as emerging from a networked society. Interest in interdisciplinarity currently comes from the centre of the disciplines as opposed to it emerging at the margins of a discipline. It is argued we are all unique individuals with different experiences and backgrounds, no two alike and therefore all at the edge and the centre, with individual frames of reference and data-input points needed for the patterned explanation of contextual phenomena. This interdisciplinarity from the centre seems to emerge from the digitisation of society where large volumes of data allow for mathematical modelling of social, psychological or other types of data. Think of computational studies, social resilience and post-normal science communication where extended networks participation and interpretations of non-scientists blur the boundaries of science and advocacy or journalism [Brüggemann, Lörcher and Walter, 2020].

Catherine Musselin from the French university "science po" argues that enforcing interdisciplinarity on staff is relatively useless. Her notion of autonomous innovation collides with interdisciplinarity from the centre. For interdisciplinarity to succeed, she argues, the university should stimulate serendipitous encounters that allow for interdisciplinarity and breaks down barriers in a natural way. Serendipity occurs in shared meeting spaces at the coffee machine, maker spaces or anywhere beyond the university where human interaction is stimulated by chance meetings, creating personal bonds and initiatives on an individual basis to bridge the divide of different epistemologies or tacit knowledge bases. As scientists are used to working in collaborative networks, the organisational structure should be the outcome of autonomously working on interdisciplinarity and not be the start of an administered and measured interdisciplinarity as presented in the previous examples.
Albeit Ribeiro [2016] in her analysis on the strength of network ties and the level of interdisciplinarity shows that strong relationships of researchers appointed at a faculty department in research universities decrease the level of interdisciplinary research. Thus, institutional constraints are limiting the effects of the networked society and interdisciplinary research and communication [Ribeiro, 2016].

Interdisciplinarity within academia vs. between academia and the public

Robert Frodeman, one of the speakers, very much emphasised the need for cooperation with people outside science and case-oriented research [Szöllösi-Brenig, 2019]. National Research Council [2014] in its study on health-related topics, proposed the term convergence as going beyond closer vs wider interdisciplinarity as described above, creating interaction mainly between scholars and professionals of various disciplines. *Convergence* is an approach to problem-solving that cuts across disciplinary boundaries to form a comprehensive and synthetic framework at the interface between different fields. Two properties are needed; one being "expertise" and one "a network of partnerships across and beyond the institutional boundaries". The proposed mode of encompassing these different interdisciplinary teaching/research/industry/government nexus would be convergence. Successful convergence according to National Research Council [2014, p. 96] is engendered at the university, by distributed leadership and commitment to convergence (comb-shaped individuals), inclusive governance and culture, goal-oriented vision, stable support, facilitating the bridging of cultures, and catalytic funding and open to high-risk endeavours. Research requires an ecosystem of different stakeholders within and beyond the university walls with a thriving spin-off partnership with industry.

Simon Chaplin exemplifies this notion of convergence in his story of the "Welcome trust" based in London, where "health initiatives for the well-being of citizens" are sustained. Their mission is "to improve health for everyone by helping great ideas to thrive". The research itself is characterised as strong disciplinary research, with active cultivation of cross-disciplinary work and bridging the gap towards the public. The initiatives supported are involving different parties, such as industry, artists, public, governmental bodies, and scientist. The activities take place in a dedicated space usually on neutral grounds outside the universities, which is according to Chapman, a decisive pre-condition for open and respectful cross-disciplinary communication. The space is accessible for a fixed period and in a location accessible and stimulating interaction with the public.

Chapman's view is that possibly interdisciplinarity is not exactly characterised by integration per se, but should rather be called entanglements between different stakeholders. The "how" of this entanglement is and should be the object of study, as activating energy for interdisciplinarity as such is low. Chapman observes this research into the "how" should be using reflexivity on interdisciplinary constructs. Furthermore, it should take the emotional side of crossing the conceptual bridges into account, as it is taxing and taking time. This can be addressed by using socio-technical systems theory, social-ecology or humanist ecology to just name a few, to explore biology and how this relates to human health and disease from a common conceptual framework. Valuing a diverse and respectful culture across the disciplines and stakeholder parties.

Building collaborative identity

Should the university as an educational institution, prepare students for interdisciplinary realities in the global market [Lyall et al., 2015] by training on collaborative skills and multiple literacies? Is communicating across the

disciplinary divides enough to engender new and innovative results, to solve societal challenges and to explore new perspectives in fundamental sciences. Some participants argued that it is merely a question of our time to develop multiple disciplinary literacies enabling low threshold interactions and stimulating the crossing of boundaries to the advantage of society at large. Creating empowerment and self-direction is an immediate benefit and spin-off for academics and the public, to transform and realise cultural/disciplinary/systemic change. Indeed training should be available to acquire the needed collaborative skills, multiple literacies and language that creates additive values and results.

However, as Chapman points out, it is crucial to recognising the realistic difficulties that need to be overcome, such as the emotional impact from interdisciplinary ways of working and severed by trial and error approaches to problem-solving [MacLeod, 2018]. Cognitive difficulties, equally need to be overcome when starting a discussion on epistemic theories and concepts [Ribeiro, 2016; Lattuca, 2003; MacLeod, 2018; Andersen and Wagenknecht, 2013]. MacLeod [2018] and MacLeod and Nagatsu [2018] show that the interdependencies between theory, methods, technologies, epistemic values, cognitive structures, tacitly known to define a discipline are essential to solve problems effectively and efficiently. Integration of disciplines involving collaboration and multiple literacies, with different epistemic cultures does not necessarily result in more effective and efficient problem solving with better innovations or novel insights [MacLeod, 2018; Huutoniemi et al., 2010]. An additional complicating factor is that epistemological authority leads to asymmetrical funding and consequently, asymmetrical processes of communication [Halpern and O'Rourke, 2020; Gardner, 2013]. Typically, knowledge claims from the hard and soft sciences, even in collaborative efforts have differential power, both in communication between the sciences and sciences and society [Gardner, 2013].

Therefore, one needs to know and understand according to the seminar participants "who is doing the questioning". Nothing can be seen outside of the perspective of which we see something. As such, all understanding and seeing are partial, incomplete and unique [Halpern, 2019]. To know where the question originates from shows the strength and weaknesses of integration, its additive and subtractive values to different stakeholder audiences, the asymmetry and power structures between different stakeholder parties and disciplines, the level of trust and space needed to respectfully exchange values, beliefs and methodologies. Last but not least, it needs standard criteria on how interdisciplinarity results and impacts are measured.

Overcoming dependencies on disciplines in interdisciplinary communications takes time and frustration, yet allows for a whole new way of teaching and learning. Epistemic fluency, reflexivity and assumption testing are vital skills, on top of multiple literacies and collaborative skills, to bring to the table either in Research or Education [Ophir, Walter and Marchant, 2020]. Consequently, training to bridge the divide creates more space for mutual understanding and new ways of thinking about seemingly-established approaches to knowledge-building.

Narrative voices of interdisciplinary research and teaching

In this paper, we have addressed what interdisciplinarity might be, how it can be organised, the added value to research and some of the barriers in understanding and communicating about the field of interdisciplinarity. The focus has been on how the seminar participants explain the notion of interdisciplinarity from their perspectives and experiences, supported by literature/literary viewpoints. Throughout the seminar, meaning-making reflections have taken place, seeking to establish shared identities, language and imaginations about the scientific and non-scientific notions of interdisciplinarity [Davies et al., 2019]. As such the seminar has been the epitaph of "Research at the forefront of knowledge building, contributing to wider social communicative processes, foregrounding the need for society's advancement through critical enquiry and analysis [Wernli, Darbellay and Maes, 2017]. " However, the meaning-making process does not necessarily solve the proposed dilemmas of a communicative framework of "in-between" disciplines. The study of the interdisciplinary construct, its theories, practices, identities and experienced obstacles are as diverse as disciplines itself. We observe that even though these are all scholarly participants, they are in the process of meaning-making from their particular frames of reference and identity. They did not yet seem at a level of disentanglement, where knowing what is known by science and being whom they are as members of different scientific communities with interdisciplinarity, led to a mutual agreement on the notions of inter-discipline [Kahan, 2015]. It shows the breadth and depth of interdisciplinarity and creates a notion of interdisciplinarity being a black hole where densification leads to an increase in complexity, expansion and exploration of new matter.

It also shows how dispersed the community still is and makes one wonder. How can interdisciplinarity be catered for and communicated to a broader audience, if experienced scientists are still struggling to lay a foundational frame of consensus to advance the interests of interdisciplinarity in the institutionalised and discipline governed universities of the 21st century?

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Panel discussions. Uskuli Maki, Centre for Philosophy of Social Science, University of Helsinky, Finland. Rudolf Stichweh, Forum Internationale Wissenschaft, University of Bonn, Germany.

Session II. Mapping interdisciplinarity and research — frameworks and structures. Short interventions with best and worse practice examples and panel discussion: Simon Chaplin, The Wellcome Trust, London, U.K. Christine Musselin, Sciences Po, Paris, France. Marijke van der Wende, Faculty of Law, Economics and Governances, University of Utrecht, the Netherlands. Stephen Hartman.

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