On the Importance of AI Research Beyond Disciplines: Establishing Guidelines

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On the importance of AI research beyond disciplines: establishing guidelines[1]

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***Abstract**: Artificial intelligence (AI) has evolved into a prominent player in various academic disciplines, transforming research approaches and knowledge generation. This paper explores the growing influence of AI across diverse fields and advocates for meaningful interdisciplinary AI research. It introduces the concept of "agonistic-antagonistic" interdisciplinary research, emphasizing a departure from conventional bridge-building approaches. Motivated by the need to address complex societal challenges, the paper calls for novel evaluation mechanisms that prioritize societal impact over traditional academic metrics. It stresses the importance of collaboration, challenging current systems that prioritize competition and individual excellence. The paper offers guiding principles for creating collaborative and co-productive interdisciplinary AI research environments, welcoming researchers to engage in discussions and contribute to the future of interdisciplinary AI research.*

Artificial intelligence (AI) is increasingly becoming a product, an object and a tool of research across a wide range of disciplines spanning the humanities, social sciences, natural sciences and applied science. The methods and results of AI research are increasingly becoming a part of many scientific fields, affecting not only the objects of research but also the ways in which research is conducted and knowledge is generated. AI brings new research objects, new tools and methodologies, new ways of thinking and new ontologies to the research community. These developments have driven a broad interest in and uptake of “ethical, legal and social issues” (ELSI) approaches to interdisciplinary collaboration between social scientists and other disciplines in AI research (see Balmer et al., 2015 for a discussion of ELSI approaches). The rapid uptake of AI has also led to concerns about its social impact and to efforts at regulation, such as

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the AI Act in the making by the European Union,[2] or the recent call from the United Nations for international governance of AI.[3]

Scholars, such as Kusters et al. (2020), have also called for a bidirectional relationship between the disciplines developing new AI technologies and those that are incorporating AI technological advances into their research methodologies. Furthermore, interdisciplinary approaches to teaching are being proposed (Coriou et al., 2022), and indeed have been institutionalised, such as the Embedded EthiCS programme at Harvard (Grosz et al., 2019). Building upon these efforts, in this paper, we make a renewed and more ambitious call for meaningful interdisciplinary AI research and propose a set of guiding principles for the nurturing of a research environment that not only recognises, but promotes, enables and values AI research beyond existing disciplinary boundaries.

1 From Bridge Building to Restructuring: An Agonistic-Antagonistic Mode of Interdisciplinary AI Research

The use of the term "interdisciplinary" has become ubiquitous in scholarship and a "widespread mantra for research" (Graff, 2015, p. 1; Klein, 2008, S116; Van Noorden, 2015)." While the term interdisciplinary has only formally been used from the 1920s onward, interdisciplinarity is not historically novel (Frank, 1988; Sills, 1986; Klein, 1990; Barry & Born, 2013). Many disciplines that are now seen as established and autonomous, such as astronomy and Science and Technology Studies (STS), began life as or have been transformed by interdisciplinary research and contexts (Schaffer, 2013; Graff, 2015, Chapter 1; Jasanoff, 2016). As Schaffer (2013, p. 58) evocatively notes, many "disciplines are interdisciplines about which the same kind of amnesia has occurred."

There are parallels between our claims for the recasting of the disciplinary framework around the study of AI, and those of the broader contemporary multidisciplinary, interdisciplinary, and transdisciplinary movements that have been active since the 1920s onwards (see for example Barker, 2008; Bernstein, 2015; McClam & Flores-Scott, 2012). In this paper, we deliberately use the term interdisciplinary rather than multidisciplinary or transdisciplinary (Gibbons et al., 1994; Klein, 2017). In cutting through this definitional thicket, we draw upon Barry, Born & Weszkalnys' (2008, p. 27) understanding of the term interdisciplinary as capturing a spectrum of practices from mere cooperation between disciplines, to attempts to synthesise and integrate perspectives from different disciplines, to attempts to transcend and transgress existing disciplinary objects, norms, practice and knowledge.

Here, interdisciplinary research can be seen as a form of "bridge building" or "interstate highway construction" between existing disciplines (Klein, 1996, pp. 10–11; Jasanoff, 2017, p. 105). Although there is value in this form of interdisciplinary work, it often lacks critical reflection on how problems are understood, disciplines' epistemologies and "the

[2] https://artificialintelligenceact.eu/the-act/
[3] https://www.un.org/techenvoy/ai-advisory-body

logic of disciplinary structure" (Klein, 1996, p. 11). Existing disciplines remain unchanged by "bridge building" and the degree of integration that bridge building fosters can be asymmetrical (Viseu, 2015). Dominant gatekeeper disciplines can and do control access and the direction of flows across bridges "with one or more disciplines … organized in a relation of subordination or service to other component disciplines (Barry, Born, & Weszkalnys, 2008, p. 28)." Here, for example, the "ethical, legal and social issues" (ELSI) mode of interdisciplinary research, which emerged from the Human Genome Project and has been mirrored across a wide range of scientific and technological advances including AI research, creates a clear division of labour between the work that the scientists and engineers do and the work that the lawyers, ethicists, and social scientists undertake. Such a division of labour not only creates an "epistemological gap" between "science and "society" (Balmer et al., 2015, p. 4 and p. 7) but this approach to interdisciplinary research also inhibits reflexive and co-productive collaboration by positioning social scientists downstream from scientific or technological development as representatives of the public or as voices of (negative) critique. As Balmer et al. (2015, p. 8 and p. 10) note, interdisciplinary research based upon this type of bridge building and division of labour forecloses the possibility for the "co-production of knowledge of problems, knowledge and innovations" and "the possibility for transforming the practices of scientists themselves."

Following this line of thought, we recognise that the call for and practice of interdisciplinary approaches to AI research is established in such that the methods and outcomes of AI research and practice are increasingly becoming a part of many scientific fields, affecting the way of conducting research and generating knowledge. AI brings new tools and methodologies, new ways of thinking and new ontologies to the research community. As argued by Kusters et al. (2020), it is increasingly important to establish a bidirectional relationship between the disciplines developing new AI technologies and those that are incorporating AI technological advances into their research methodologies. Despite this, a "bridge building" approach to interdisciplinary research has led to a tendency to either see other fields of knowledge as "sources of inspiration" for technological development, create new exclusionary silos around the study of AI and society that replicate the disciplinary model, or fail to uncritically adopt the tools, practices and knowledge of existing disciplines. Here, for example, there have been calls for a bidirectional relationship between the disciplines developing new AI technologies and those that are incorporating AI technological advances into their research methodologies (Kusters et al., 2020). Instead of *pushing* new AI developments that might not be aligned with individual research paradigms and methodologies in the adopting disciplines, it is crucial that these disciplines have the ability to feed back their demands, requirements, and concerns, to actively and efficiently govern AI development.

When scientific discovery is conceptualised as a process in which existing knowledge is recombined to create new knowledge, a process that continues perpetually in a dynamic knowledge landscape, then AI serves as a valuable tool for scientists, expediting data analysis and freeing them to focus on creativity and exploration (Bianchini et al., 2022). However, by definition, data-driven models prioritise consensus over absolute truth. While AI excels at sifting through vast datasets and revealing patterns, it may not always discern objective truths, as biases can taint both data and algorithms. Science encompasses

more than data crunching; it involves hypothesis formulation, experimentation, and critical thinking. Statistics and data-driven models as employed by AI provide a seductive way to accept correlations instead of the time-consuming work of checking the scientific evidence about causal relations (Coeckelberg, 2022).

As such, what we argue in this paper is the need of an "agonistic" interdisciplinarity between humanities/social sciences and AI research that moves beyond “integrative-synthesis” or “subordination-service” modes of research (Barry, Born, & Weszkalnys, 2008, p. 28). The form of interdisciplinarity that we are advocating in this paper seeks to move beyond the building of bridges between disciplines and is concerned with “restructuring” or exploring the spaces between disciplines (Klein, 1996, pp. 10–11; Jasanoff, 2017, p. 105). This “agonistic-antagonistic mode” of interdisciplinary research is understood neither as a form of a strict division of labour between existing disciplines nor the synthesis or integration of existing disciplinary tools and knowledge, “but as driven by an agonistic or antagonistic relation to existing forms of disciplinary knowledge and practice (Barry, Born, & Weszkalnys, 2008, p. 29).” As Barry & Born (2013, p. 12) note, such an approach to interdisciplinary research is driven by a “desire to contest or transcend the given epistemological and/or ontological assumptions of specific historical disciplines”.

2 The Synoptic and Instrumental Logic of Interdisciplinary AI Research

There are several commonly articulated motivations for interdisciplinary research, all of which revolve around a vision of research that is responsive to society and the broader public good. The synoptic and instrumental justifications are not mutually exclusive and can be driven from within the academy as well as from exogenous societal, economic, and political pressures. These motivations for interdisciplinary research are punctuated by “a common pattern of justification – that of ‘necessity’ or ‘complexity’”(Klein 1990, p. 44). Moreover, scientific and technological development and their impact on individuals, society, and the natural environment is a key through line to these logics of interdisciplinarity that have been dominant since the emergence of the term in the 1930s (Klein, 1990, p. 38; Jasanoff, 2007). Our call for interdisciplinary research is driven by both instrumental and synoptic logics, but importantly is not driven by societal, political or economic demands for a change in the academy but driven from within and from a reflection of the lived experience of the authors of the paper.

Meeting the societal, cultural, and scientific challenges of AI requires courageous and collaborative research that cultivates and engages with a diversity of perspectives. The diversity of societal, environmental, and humane expressions cannot be engaged from a single cultural interpretative framework (Ihde, 1993, pp. 114-115). Here, interdisciplinary research is inherently more capable rendering those that undertake research accountable and reflexive to the concerns and needs of society (Gibbons et al., 1994; Strathern, 2004; Barry & Born, 2013, p. 3). Furthermore, interdisciplinary research is driven by a broader realisation that certain problems cannot be solved by the methods, knowledge and expertise of a single discipline (Klein, 2017; Nature, 2015). As Roy noted over four

decades ago, "*new interdisciplinary patters*" have been driven by "*the inexorable logic that the real problems of society do not come in discipline-shaped blocks*" (Roy, 1979, p. 165). For these reasons, studying technologies should be conceived as a post-disciplinary practice that enables cross-cutting lines of inquiry, embraces pluralism, and addresses real-world problems (Waisbord, 2019). Such an approach to research should advance new methods to analyse, design, develop, evaluate, critique, and assess the complex interactions between technologies and human actors. Having the openness and respect to learn the contributions that perspectives of other disciplines can bring and being humble enough to reflect upon our disciplinary limitations, and trying to combine them into a new approach for current problems is key to success. A non-hierarchical dialogue between disciplines is needed, in a mode of interdisciplinarity that Born (2020) refers to as *agonistic* and that enables all contributing disciplines to grow through "mutual transformations" and generate "entirely unforeseen, novel methodologies and theories" (Born, 2020, p. 200).

Interdisciplinary research on AI and autonomous systems is a much-needed step towards understanding and addressing their impact on humanity and society (Dignum, 2020). This step is not so much a goal in itself, but the central means to study and analyse different facets of a given issue, thus developing new ways to understand the world and bringing about positive change in both the research community and society. Interdisciplinary research should primarily be assessed by its capacity to generate positive impact and justice for both the individuals and the society, as well as its ability to push debates beyond the status quo and to propose alternatives on how to address societal consequences. At the same time, the main communication channels in society have been shifting, and this shift is initiating a need for evolution of academic knowledge dissemination, to ensure the societal relevance of scientific knowledge.

Finally, an agonistic mode of interdisciplinarity is necessary because humanities and social sciences have so far been predominantly focused on the conceptualisation of intelligence as a human property. However, current societal challenges posed by artificial intelligence (AI) technologies require new research perspectives and novel, collaborative ways to look at the world (D'Ignazio & Klein, 2019). Even though it is engaging to think of AI systems as agents that can be studied as humans, they are engineered systems, fundamentally implementing the values of those that commissioned, designed, or managed them, and therefore demand new scientific methodologies and theories in general and from the humanities and social sciences in particular (Rahwan et al., 2019). Humanities and social sciences need to fundamentally adapt their focus, research questions, data, and knowledge, to include investigations into both artificial systems and natural intelligence and behaviour. In contrast to our instrumental justifications, our concern here is a broader "synoptic" justification driven by "ideas of unified science, general knowledge, synthesis and integration of knowledge" as a "powerful warrants for interdisciplinary thought" (Klein, 1990, p. 41; 1996, p. 8). We argue for the need of an "agonistic" interdisciplinarity between humanities/social sciences and AI research that is driven by the "desire to contest or transcend the given epistemological and/or ontological assumptions of specific historical disciplines" (Barry & Born, p. 2013). We regard this as

necessary, because humanities and social sciences have so far been predominantly focused on the conceptualisation of intelligence as a human property.

There are parallels between our claims for the recasting of the disciplinary framework around the study of AI, and those of the transdisciplinary movements (see for example Barker, 2008; Bernstein, 2015; McClam & Flores-Scott, 2012). Indeed, the value of adopting a transdisciplinary approach to teaching AI is already being discussed (Coriou et al., 2022). However, a key distinction is that while the transdisciplinary movement was driven by societal demand for a change in the academy, our approach is one driven from within. It demands of us that we actively develop a culture which Nowotny et al. (2001, p. 210) refers to as 'scientific accountability' over 'scientific autonomy', as we pursue 'socially robust knowledge'. Similarly, the call for an interdisciplinary approach to AI is well established in certain regards (Kusters et al., 2020). Yet, there is a tendency to either see other fields of knowledge as "sources of inspiration" for technological development, or to create new exclusionary silos around the study of AI and society, replicating the disciplinary model. Our agonistic approach pushes the demand for interdisciplinarity further. It does so, not from a hypothetical perspective, but as a reflection of the lived experience of the authors' of the paper.

3 The Challenges of Interdisciplinary AI Research

Agonistic interdisciplinarity that moves beyond existing disciplinary boundaries is however hard to realise. It is difficult to evaluate using conventional methods for assessing and measuring research (Klein, 2008; McLeish & Strang, 2016). Disciplinary evaluation of research is based on the techniques, models, and methods that define that discipline. Interdisciplinary research requires the identification of common ground, the co-production of research questions and research design and developing interdisciplinary skills (McLeish & Strang, 2016, p. 4). In research beyond disciplines, each project must create its own methodology based on and transcending the practices of all disciplines involved. Interdisciplinary research in AI requires scholars to undertake and shift between different roles, from the critic to the co-producer of technology (Balmer et al., 2015, p. 20). That takes time and needs to be done very carefully with understanding of, and respect for the traditions of each discipline. As Balmer et al. (2016, p. 77) explain, interdisciplinary research requires a sense of "neighbourliness" where we:

> [W]e recognise our differences and to respect them, whilst seeking to welcome each other without losing our sense of ourselves and our own commitments, responsibilities and proclivities. It … does not mean shying away from conflict, but rather making conflicts and their causes part of how we collaborate.

It especially requires open minds that are not afraid to take risks and to explore new territory that may not traditionally be valued by some of the disciplines (Balmer et al., 2016, p. 75). Excellence in research beyond disciplines is evident from its contributions

to knowledge creation and societal impact, rather than solely fitting existing scientific methods.

Nevertheless, currently, academic career progression is closely tied to the contribution to existing disciplines, through research outputs, funding, teaching and other areas of professional practice, following traditional lines of epistemic trust as basis to the understanding and use of scientific information. With a rapidly growing body of information resulting from generative AI, novel approaches to scientific thinking are needed to deal with the erosion of epistemic trust, including and recognising the contributions of research beyond disciplines. A core motivation for doing research beyond disciplines is to cultivate our ability to engage in societal challenges for which we want to contribute knowledge.

Collaboration rather than competition lies at the core of successful and meaningful research beyond disciplines. The creation of epistemic communities is at the heart of interdisciplinary research (McLeish & Strang 2016, p. 4). This stands in stark contrast with current systems of research assessment and evaluation that valorise, prioritise and reward competition and individual excellence. The emphasis on competition is not compatible with a system that values contribution to society. In line with the EU Open Science Policy,[4] we see contribution to society as a fundamental part of open and responsible science, and call for its consideration when evaluating research excellence. We call for novel evaluation mechanisms that give importance to exploration of new research grounds and the generation of new research questions. Excellence in this context is not standing out as an individual (person or group) but the capacity to bring together different voices, pushing forward through unexplored fields and learning from failure.

4 Guiding Principles for the Creation of Collaborative and Co-Productive Interdisciplinary AI Research Environments

Research beyond disciplines is imperative to address complex societal questions that arise at the nexus between the living and technology, focusing on the same problem for which we want to build knowledge from different viewpoints provides new perspectives and contributes to all disciplines. As researchers in AI coming from many different disciplinary backgrounds, we therefore seek to create an environment in which research beyond disciplinary boundaries is enabled, recognised, and valued. We put forward ‘guidelines’ to address and structure new opportunities for collaborative research between disciplines that often have not worked together before. We propose the following guiding principles for AI research beyond disciplines as a starting point for discussion:

1. Recognise that the distinct contribution of AI research beyond disciplines to knowledge creation.
    - It has the added value of discovering and addressing complex issues that ‘fall in between’ the lines.

[4] See https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science_en

2. Scrutinise the use of single-disciplinary AI research, rather than approaches outside existing disciplinary boxes.
    - The reviewing processes for research work on AI and autonomous systems must standardly include the question “justify why only one discipline was applied?”
3. Measure the quality of AI research beyond disciplines by its capacity to engage stakeholders and contribute to a process of change:
    - How often research has been cited is less important than its reception by a border public.
4. Evaluate, recognise and value the novelty and transformative potential of ideas, theories and methodologies beyond disciplinary boundaries.
    - Does the application of AI just improve some results of another discipline or does the combination really produce new insights that can open up a new area of research? Think e.g. of areas like personal medicine that was made possible by AI techniques but started a new way of thinking in developing medicine.
5. Accept and facilitate researchers who do not associate themselves and their research to existing disciplines and recognise the institutional and professional barriers to interdisciplinary AI research.
    - Interdisciplinary work, by definition, is published in a diverse set of journals and conferences and thus references are made to it from a diverse set of communities, which can lead to a less high score on h-index etc. The real results of this novel work is often only seen after five to ten years when a new community is formed around the new insights!
6. Demand that AI research goes beyond technological solutionism:
    - Using AI in the sense of using ML to improve some technical issue can prevent people finding a fundamental new solution. E.g. AI can be used to manage traffic lights in a city to improve the flow of traffic, while neglecting the solution to reduce the number of cars on the road (in the rush hour).
7. Give AI research beyond disciplines time.
    - Example: Projects between disciplines and in dialogue with society take longer time than the next disciplinary experiment. Participants need time to learn each other’s perspectives, ontologies and methodologies. Only after that has been done some real innovative results will be possible.

We invite all researchers working on the design, development, analysis, critique and evaluation of AI and its societal impact, to join us in discussing, reshaping, and implementing these guidelines.

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