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Crowded Intersections

Transdisciplinary Tendencies in Social Sciences and the Humanities[1]

ABSTRACT

In this paper, we argue for the applicability of current transdisciplinary tendencies in social sciences and the humanities in the case of research topics in which two or more fields are involved. In the past decades, many texts have been produced that discuss the pursuit of scientific activities and scientific production while also highlighting the terminological and historical aspects related to these. Often, polemics emerge on whether the distinctive/distinguished terms truly denote different phenomena, or they are merely empty expressions in vogue now in scientific discourse. This latter approach is most often notable in the case of inter-, cross-, and transdisciplinarity.

An observer of these processes has to suffer from the multiplicity of interpretive frameworks behind these views, even though the given definitions, paradigm shifts, and processes seem quite obvious. In order to clarify the state of the field, we review historical approaches to disciplinarity, its modern and post-modern characteristics, while subsequently enumerating the necessary steps of transdisciplinary scientific production. The paper concludes with a case study of a research project, which exemplifies the distinct features of transdisciplinary research.

KEYWORDS

disciplinarity, transdisciplinary research, narrative psychology, religion, collective national identity

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In this paper, we argue for the applicability of current transdisciplinary tendencies in social sciences and the humanities in the case of research topics in which two or more fields are involved. In the past decades, many texts have been produced that discuss the pursuit of scientific activities and scientific production while also highlighting the terminological and historical aspects related to these. Often, polemics emerge on whether the distinctive/distinguished terms truly denote different phenomena, or they are merely empty expressions in vogue now in scientific discourse. This latter approach is most often notable in the case of inter-, cross-, and transdisciplinarity.

An observer of these processes has to suffer from the multiplicity of interpretive frameworks behind these views, even though the given definitions, paradigm shifts, and processes seem quite obvious. In order to clarify the state of the field, we review historical approaches to disciplinarity, its modern and post-modern characteristics, while subsequently enumerating the necessary steps of transdisciplinary scientific production. The paper concludes with a case study of a research project, which exemplifies the distinct features of transdisciplinary research.

1. Mode 1 and Mode 2

The introduction of the term "transdisciplinarity" is related to the conviction that science has transcended its former, disciplinary state, which may termed as Mode 1 of scientific production to its Mode 2 (Gibbons et al. 1994). Briefly, this means that although the division of different fields, rooted in the academic custom of the 19th century, was structured disciplinarily, meaning that the results of a given discipline were applied in a second step, Mode 2 *initially* requires the research project to have a practical goal and as such, practice and theory are not differentiated, the research always being goal-oriented. In many cases, this means that in a Mode 2 research project, there are a number of specialists who usually achieve results in intersections between disciplines. Thus, the age of the solitary scholar has come to an end: different sites of research are connected by communication networks, the organizational unit of a Mode 2 project is the team, and its main platform of communication is the Internet.

Although in Mode 1 there is a barrier between science and innovation, showcasing a powerful distinction between theory and practice, science and technology, in Mode 2, theory and applicability are continuously intertwined (Soós 2003), with scientific production becoming transdisciplinary. This is characterized by the application of joint methodologies and models in different fields, and the fact that questions and issues emerge outside disciplinary barriers and equally, the solutions are to be looked for outside these boundaries, too.

2. Approaches to disciplinarity

Veres (2015) suggests that it is necessary to view the problem of disciplinarity both from modern and post-modern perspectives. In case of the former, disciplinarity appears as a historical category, denoting the differentiation of natural, social, economic, and political realities in the form of traditional branches of science that are shaped according to different epistemological specificities. As with the multiplication of interpretive frameworks there appeared a number of new methods and focuses of scientific research, so did the distinctive areas of expertise became more and more in-depth and – simultaneously – isolated. However, this was also the process through which boundaries became overtly narrow for the different disciplines, culminating in an increasing need and desire to cross disciplinary barriers and to initiate cooperation between academic fields. (Veres 2015, 3 Cf. Klein 2006.).

This process means both the incorporation of theories and methodological considerations, or actual cooperative research projects between professionals. In other words, as soon as the amount of knowledge accumulated overbore the disciplinary boundaries and methodological rigor of the different fields, various forms of transgressing these boundaries fractured their mono-chromatic nature. (Barry et al. 2008)

Although the category of disciplinarity in itself suggests that it is a closed circuit, one-dimensional form of scientific production, if we look at this process from a historical perspective, it becomes clear that the dichotomy that claims disciplinarity to be homogenous and inter- and transdisciplinarity to be heterogeneous is fundamentally mistaken. There is, in fact, an inherent diversity within the given academic fields that allows transitions towards new approaches and methodologies, and on a chronological curve, these inherent developments create new connections between theories and methods, meaning that boundaries themselves are constantly shifting. (Barry et al. 2008)

If we were to view this issue from a postmodern perspective, we must acknowledge that the attempt on behalf of the hard sciences to claim validity for their concept of science in all academic fields is increasingly under scrutiny, which resulted in the appearance of new perspectives and the reinterpretation of former aspects. The problems arising with hermeneutic interpretation and the subsequent conflicts over the definition of the "scientific" resulted in questioning the foundations of science instead of the illusion of being in possession of objective and empirical truth. In this tradition, the focus is no longer on the application of firm and prevalent theoretical and methodological structures, but instead on the horizons of dynamic changes, the options of possible perspectives, or the interpretive frameworks of "truth" as it is currently conceptualized, these being the new and cooperative concepts of scientific communities.

On the other hand, the reign of postmodernism brought about a newly found focus on particularity, applicability, and regional characteristics, which means an increasing demand of closing the gap between theory and practice. This assertion has led to the specificities of Mode 2 of scientific production, meaning that certain aspects of research transcend scientific boundaries due to the newly emergent demand on applicability. These assertions also mean that the context of transgressing these boundaries can be identified as a state of uncertainty, in which not only the questions and the range of possible answers, but the process of disciplinary reorganization are also uncertain. (Veres 2015)

In this process, the myth of rigorous and seemingly stable boundaries between disciplines also begin to erode, new attempts at paradigms and paradigm shifts emerge; research itself enters

center stage, and not the theoretical homogeneity behind these endeavors, while simultaneously new and formerly undiscovered phenomena appear in the scientific corpus. As an obvious end of this process, we may talk about a differentiation between disciplinary characteristics, while isolation of the bodies of knowledge claimed by the different disciplines becomes apparent. This results in the dissolution of said boundaries, urging the former, unidisciplinary paradigm to shift. (Nissani 1995)

3. Intra-, multi-, inter, cross, trans

While the uni/intradisciplinary approach offers a relatively straightforward model, if we are to compare inter/multidisciplinarity, it becomes apparent that these are not radically divergent approaches. The characteristics of the different models and the adjunct matrixes of research methods and approaches are skilfully summarized by Jensenius in his 2012 text (Jensenius 2012). The term "intradisciplinary" denotes a traditional approach to scientific production, in which research is focused on a single given discipline in which professionals rely on the terminology and methodological foundations of their own discipline. Essentially, this is what Gibbons describes, as mentioned above, as Mode 1 of scientific production.

In the case of multidisciplinarity, a multifaceted approach is needed due to the complexity of the problem under scrutiny, the consequence of which is that researches from multiple areas work on the same project. However, they remain in the comfort of their own fields and contribute the results of their own research to the final output. Participants do not transgress their own boundaries; multiple perspectives are present but neither the theories the participants rely on, nor their results are integrated.

Interdisciplinary projects differ from the formerly discussed ones, as the focus of research is primarly on issues that are in the intersection of different disciplines. Thus, researchers from more than one fields strive to unify their approaches and already established bodies of knowledge and try to internalize and amalgamate each concept and approach brought to the table in order to fulfill their research goals. While in the case of multidisciplinarity, respective fields coexist in a parallel way but without transgressions, interdisciplinarity results in an interaction between these fields in a way that enables the creation of new, unified theoretical and methodological approaches. Therefore, results are more likely to be coherent and integrated.

In many cases, the distinction between inter- and transdisciplinarity is far from self-explanatory; many argue that transdisciplinarity is nothing more but interdisciplinarity done right, so to say, while others claim that uni/intradisciplinarity and transdisciplinarity are two ends of the same spectrum, the latter being the most extreme form of interdisciplinarity.

Nowotny (2003) draws our attention to the fact that some view interdisciplinarity as a rhetorical tool of science politics, a mere empty signifier that emerged as a way of dissolving the antagonism between the isolation of fragmented disciplines and the idealized unity of science. Visvanathan (2002) and Sperber (2003) also argue that the implementation of true interdisciplinarity is highly questionable, for it is impossible to integrate seemingly incomparable approaches within a single institutional context. In their view, cooperation is possible only on the platform of multidisciplinarity.

Regarding cross-disciplinarity, a given perspective or methodology of one field is being used for the purposes of another. This can mean the incorporation of a given theory or the application of a methodological framework, but without aiming to involve the totality of other disciplines. Compared to these, we may define transdisciplinarity as cooperation between paradigmatically different fields in a way that the questions a given project aims to provide answers for come from outside of the disciplines involved, or any disciplines at all. (Jensenius 2012)

First, transdisciplinarity was interpreted as a meta-theoretical perspective of interdisciplinarity, while today, it is a term that is mostly used for research projects that aim not only at creating interdisciplinary cooperation and interaction between respective fields, but at placing these connections in a completely new framework, unburdened by disciplinary boundaries. (Bernstein 2015) This model bears four different characteristic features: (1) it is mainly problem-oriented, but the solutions offered are not derived from the application of already prevalent knowledge, but from the issues arising directly through application and applicability. (2) This model is not disciplinary in nature, meaning that it can go towards multiple directions without the need to adhere to the theoretical or methodological constraints of a given discipline. (3) The results of such a transdisciplinary project is instantly communicated by its participants, and (4) it is considered to be a dynamic model, meaning that the direction the project may take due to the issues emerging is unforeseeable.

These features are directly related to the concept of Paul Feyerabend (1975) who claimed science to be in a state of permanent revolution without uneventful phases of stagnation. According to him, the undisturbed flourishing of theories guarantees the success of science; there are no generally agreed-upon standards of rationality, no universal methodological principles: *anything goes.* This way, the merit of a theory or scientific assertion, approach, and subsequent possible discovery is determined by its validity in light of validity and applicability. Many outstanding scientific discoveries would not have been made if those that made them had strictly adhered to the rules and standards of their age. Intertwined with these assertions, transdisciplinarity has much more scientific potential than other approaches, e.g. multidisciplinarity.

Some may perceive this approach to scientific production as something that is distant from actual scientific work, and closer to market-driven/policy-driven endeavors. Although it is certainly true that, as stressed before, one of the main features of transdisciplinary research is its insistence on being solution-driven and stressing applicability, this does not mean that it is to be seen as semi-scientific. This is why Wiesmann asserted more than a decade ago that one of the challenges lying ahead of transdisciplinarity is *"facing the scientific challenge"* (Wiesmann et al. 2008), meaning striving for proper acknowledgement on behalf of the different substrates of the scientific community. Although it is difficult to state it with certainty, there seems to be a marked increase in such research projects regarding a number of issues – albeit proving this assertion quantitatively with scientific metrics and other tools sadly exceeds the limitations of the present paper.

Knowledge produced by transdisciplinarity is transgressive, since its primary aim is the creation of a common platform, the direct consequence of which is its disregard for institutional boundaries. Its structure, however, is characterized also by the fact that it cannot be reduced to belong to any of its constituent disciplines. Moreover, the specificities of the given research project are determined not by already existing practices, but by consensus reached the participants, the result of which is that knowledge is produced in a network of multiple actors. (Nowotny 2003)

Related to this, we may also emphasize the role of transdisciplinarity in increasing the capacity building potential of scientific communities. As this approach not only enables, but also frankly requires greater cooperation between researchers, research groups, or networks, several actors of scientific production must adopt to these new circumstances. Due to the volume of such projects, funding opportunities need to be increased, which in turn can be viewed more favorably by the general public, as research in this sense focuses on "real-world applicability". On the other hand, these projects also have the potential to enhance technological development as well, because targeting newly emerging problems in an increasingly digital age and attempting to design solutions to them in a way that transgresses the boundaries of deeply rooted structures that seem to have little contemporary utility necessarily requires creating new technological solutions.

4. Mode 2 of Scientific Production

In Mode 2, the logic of scientific production changes primarily the nature of knowledge. While before, innovation was enhanced by new elements of knowledge, in this conceptualization, the novelty is to be understood as the regrouping of already established elements in a way that they supports the reorganization of problem-solving endeavors. Ultimately, transdisciplinarity is therefore to be understood as heterogeneous. This problem-oriented approach, as mentioned, bursts through disciplinary and institutional boundaries, and the ethos of closed scientific communities is replaced by networks of interchangeable and transdisciplinary research groups.

Before presenting a case study of a research project carried out by one of the authors of this paper, Réka Szilárdi, it is important at this point to detail to some extent how one might think of such a transdisciplinary research endeavor in practical terms. Whether we speak of a research group or a network of researchers, groups, we consider the following processes to be the agreed-upon, ideal-typical model for designing transdisciplinary research projects. As is the case – or should be – with all forms of research, the first step is designating a research question, a problem to be solved – fundamentally, the way our knowledge shall be extended. It is common to refer to this as *problem identification,* or as the *identification of the problem field,* to be followed by *problem analysis.* For this reason, we may distinguish three distinct, yet interconnected forms of research questions related to three separate forms of knowledge. (1) *Systems knowledge,* which raises questions about the origin and development opportunities for a given issue that comes from outside of the sphere of academia, with real-life stakes and implications. (2) *Target knowledge,* which raises questions that strive at narrowing down problems and justifying what is to be changed, what practices should be improved. (3) *Transformation knowledge,* in the case of which the related questions are targeted towards the practical ways of achieving change in their totality, including technical, social, legal, cultural and other possible means." (Pohl–Hadorn 2007) In reality, the actual, focused topic of research is the blend of these three aspects.

Simultaneously with designing of the research problem, the practical, organizational framework of the project should also be drawn up. The parties involved should designate different roles though this process, each according to their own capabilities and strengths, while also considering a decision-making structure that ideally is most beneficial for the aims of the research project and is in accordance with the requirements of the funding opportunities available. Subsequently, those involved parties with decision-making authority (the so-called *core team*) must decide

on how to undertake what is probably the single most crucial aspect of transdisciplinary research: *thematic synthesis.* (HOFFMANN 2017) This process involves the development of a method of integration that is unique in all such projects, but nonetheless provides an opportunity for all involved parties to contribute, rendering the final product coherent and in accordance with the agreed upon set of milestones, aims, and final output.

After each party conducts their research activities, these shall be assessed and synthetized on a new, common platform, during which – as customary in the case of all scientific endeavors – results are required to be validated and the model of application should also be created with the involvement of all interested parties. (HOFFMAN 2017). This process of synthetizing is to be concluded with a common reflection on the results achieved and their subsequent dissemination. Such dissemination activities should include not only the achieved results with a focus on their implementable application, whether in the form of traditional and novel forms of academic publications, reports, policy suggestions, etc., but should also include a detailed description of how these results were achieved, e. g. the transdisciplinary structure in which it was done so. The purpose for this is two-fold: one the one hand, it presents a clearer image of the respective responsibilities of constituent researchers, networks, and their contribution, which is important both on the level of personal trajectories and for the nurturing of future opportunities for cooperation. On the other, such descriptions have the potential to encourage and instruct other researchers, groups, or networks to initiate and engage in similar transdisciplinary research schemes.

4.1. Case study

4.1.1. The construction of national identity within ethnic religious communities

In the turbulent years after the regime changes in 1989, many groups have emerged in Central and Eastern Europe, including Hungary that aimed at reconstructing their *original* ethnic religions (the pagan mythology in the case of Hungary). These communities represented a novelty not only from a religious perspective but also due to the fact that they centered their views around such concepts as innate distrust towards established academic considerations regarding the topic, ethnocentrism, the sense of being a threatened minority, and an array of nationalist ideologies.

There were a number of questions that arose regarding these groups:

1. Why do they have nationalist attitudes, while similar communities aiming to reconstruct ethnic religions in Western Europe and the English-speaking world are organized along principles that are diametrically opposed to theirs?
2. What is happening to collective identity in the region?
3. How can these phenomena be approached empirically?
4. What consequences can be drawn from these results, and how should this form of ethnocentric nationalism be handled?

It was quite obvious that to answer these questions, it was necessary to involve the theoretical context of a number of disciplines, while also creating a methodological framework in which it was possible to examine the totality of this highly complex topic.

4.1.2. Theories

The theoretical foundations needed for examining the identity of these religious groups and the national representations that were attached to them were to be found at the intersection of religious studies, social psychology, sociology, anthropology, history, and political science.

To maps these issues, many theories and results produced by religious studies scholars in the past decades regarding the interplay between society and religion were used. These included a reinterpretation of secularization theories and the religious changes that accompanied them, the sociology of new religious movements and the interpretation of religion as an economic phenomenon, and the approach of cultural and religious studies towards reconstructionist religions. Along these approaches, the specificities of these contemporary pagan groups, the basic differences within their ranks, their social stratification and their social function also became discernible and interpretable.

For this multifaceted analysis, the main interpretive framework was provided by the achievements of social psychology regarding (mainly social) identity constructions. This way, with the interpretation of social comparison theory and self-categorization models, it became possible to shed light on intergroup emotions and the mechanisms of self-evaluation. Moreover, theories of social constructivism provided further perspectives for interpreting self-evaluation within the context of the dynamics of interactions.

The paradigm of narrative identity illuminated the given group's collective memory, as well as the elements and mechanisms of the inherently present narrative structures in which they are embedded. Similarly, the characteristic features of social representation theory contributed largely to the understanding the structure and different types of collective representations. When examining the multifaceted sphere of Hungarian reconstructionist religious groups, theories of ingroups and outgroups tendencies and the patterns emerging in collective memory both proved immensely useful, while the contents reflecting on contemporary and prior history also helped in capturing the characteristics of competing representations.

The theory of collective national identity, being a great example for social identity, was the starting point for the research project. The examination of national identity and its many implications were embedded in the broader framework of social sciences. A number of considerations offered by social psychology, cultural studies, and anthropology were used to understand the conceptual horizon of many issues, while also including historical and political approaches to the theory of divergent concepts of nationalisms.

The topic of historical trauma implied the discussion of psychological theories of trauma states to some extent, whereas in order to understand the region's social changes, the social psychological consequences of Hungary's communist past also had to be considered.

4.1.2. Hypotheses

The basic hypothesis of the project was that Central-Eastern European ethnic religious movements differ from their Western European and English-speaking counterparts regarding their perception of national identity in the sense that national elements are present in faith dimensions, with a special emphasis on what academic literature sees as ethnic identity. Because the roots of these differences

are most likely to be found in specific features of regional (national) identity, the contextual, linguistic and content elements of these religious texts played a major role when creating the hypotheses. They provided a basic category for the characteristic identity patterns on the one hand, and on the other, if this identity substitute was to be rooted in a sense of threatened identity, it must have been found and validated on a linguistic level. Based on these assertions, 5 clusters of textual corpuses were created with 7 different hypotheses.

4.1.3. Sample

The sample was a textual corpus of 102.000 words that consisted of the religious narratives produced by the given groups and compiled with different considerations.

4.1.4. Methods

The preliminary phase of the research project included 4 years of fieldwork during which the public events of the given groups were observed. Naturally, this involved interviews with members and group leaders alike, appended with anthropological thick descriptions of each events.

Simultaneously, after uniting the large array of theoretical approaches and scientific results on a common platform, the next step was to commit to a methodological framework. Since the aim was to examine identity contents, qualitative methods were to be used, such as hermeneutic and field analysis, as well as network analysis.

The major part of the methodology, however, was a deeply rooted in transdisciplinary convictions. This was an automatized narrative content analysis tool, NarrCat, developed by the Narrative Psychology Research Group at the University of Pécs in the past 25 years. With this highly sophisticated tool, researchers are able to carry out empirical narrative analysis in a wide-ranging variety of fields.

Scientific narrative psychology[2] is a method centered on the conviction that individuals and groups create their own narratives along different principles of composition, which represent the observable psychological states of the given individuals and groups. This method pairs principles and categories of composition with psychological categories and analyzes them from statistical perspectives. The method is also capable of diagnosing and forecasting psychological states and processes of identification in case of individuals and groups.

During a narrative categorical analysis, automatized reduction of specified data occurs: the specified narrative units are transformed into categories that serve as bases for later analysis.

The development of NarrCat was the result of close cooperation between three different fields: psychology, linguistics, and information technology.[3] Its structure was preceded by two preconditions of linguistic technology: NooJ, the linguistic development environment software that serves currently as its main platform, and Hungarian national corpuses.

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[2] This term denotes a way of pursuing narrative psychological investigations that is distinct in a sense that it strictly adheres to the criteria of empirical research. This concept was developed by János László and his research group (László 2008, 2014).

[3] The method is the result of cooperation between the following institutions: Institute of Cognitive Neuroscience and Psychology, Research Center for Natural Sciences, Hungarian Academy of Sciences; Institute of Psychology, University of Pécs; Research Institute for Linguistics, Hungarian Academy of Sciences; Institute of Informatics, University of Szeged; Morphologic Ltd.

The modularly structured systems is based on different lexicons; these were gained from corpuses representing general lexicon of the Hungarian language as well as specific texts of psychology.[4] The linguistically annotated lexicons served as input for local grammars.

Local grammars, in turn, served as input for two higher-order modules: the psycho-thematic and the relational modules (social references, negation, thematic roles). The flexibility of combining lexicons, local grammars, and modules also provide an opportunity for creating so-called Hypermodules.

NarrCat is an open and expandable system, and in its current form, it is capable of analyzing a wide variety of individual and group narratives, while allowing minor, project-specific applications, too. The system's core consists of modules (Emotion, Assessment, Agency, Cognition; Temporality and Spatiality, etc.), and each module has sub modules which consist of local grammars based on input lexicons. (Ehmann et al. 2014)

4.1.5. Research

Following the compilation of the textual corpus consisting of collective narratives, content analysis included first those explorative examinations that aimed at capturing the specific characteristics of the text in the form of thematic field analysis and hermeneutic analysis. Utilizing these, it turned out that the religious groups examined were bound to exaggerate the menacing image of a foreign power, a phenomenon that has deep social roots. Moreover, an intergenerational, heritable collective emotional pattern derives from these tendencies in which a number of ambivalent contents tend to appear, such as an unrealistic territorial insistence, a perpetual state of being threatened, the sense of self-accusation, and the over-exaggeration of the self. The data and the different theoretical considerations provided the base for further hypotheses about identity contents.

In order to discard or validate the hypotheses, the different modules of NarrCat were used. First, the corpus was analyzed using the pertaining modules of Nooj, after which the previously annotated text was revised manually with the Atlas.Ti 5.5 content analysis software. In order to eliminate false matches, actual matches were first labelled according to their positions within the relevant modules (agency, assessment, emotion). The qualitative data set was quantified, and the hypothesis were proven correct by statistical validation. The whole of this research project is accessible, as well as it's distinct parts. (Szilárdi 2006, 2009, 2012, 2013, 2017)

The whole of the research project was conducted in adherence to the model of interdisciplinarity, considering a number of aspects of said model:

1. First, it was not the disciplinary framework, but the topic itself and the problem field that prompted the involvement of different fields, theories, and approaches. During the project – although it was one of the authors of the present paper, Réka Szilárdi, who conducted the theoretical research by herself – a self-organizing research network was created with the involvement of researchers reflecting on the same problems in different countries in the region. (cf. Aitamuuro–Simpson 2013 and Szilárdi 2013).

[4] These include in-depth interviews with populations with different psychological conditions (depression, borderline, substance dependence, crisis), intergenerational interviews with traumatized families, semi-structured interviews with normal populations (regarding issues related to performance, loss, interpersonal relationships), and historical, ethnic, and national corpuses.

2. Second, the methodology itself was layered and emerged as the result of cooperation between markedly different fields, such as narrative psychology, linguistics, and information technology.
3. Third, the practical applicability of the results transcends purely scientific boundaries, since it not only explores the divergent forms of identities, but also postulates propositions for possible and applicable solutions for handling patterns of threatened/victim identities – thus fulfilling the applicability requirement of transdisciplinary approaches.

Conclusion

As we have tried to demonstrate above, transdisciplinarity is different from other forms of scientific production. The range of issues examined are wide and the emerging problems transgress disciplinary boundaries – it is much more practical, and its output can be characterized as transdisciplinary knowledge value chains. In essence, transdisciplinary approaches tend to deal with problems outside of disciplinary boundaries and does so with methods that are to be found there, as well. It enhances cooperation between seemingly isolated fields of research instead of different disciplinary fortresses, secluded from and suspicious of each other. These knowledge value chains have to potential to connect the humanities, and the various branches of social and natural sciences for a common goal. Based on these observations, it is safe to state – without stretching credulity – that transdisciplinary research truly represents the way forward both for research endeavors in particular and scientific production in general.

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