Boundary Work

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Definition

The term *boundary work* is conventionally traced in science studies to Thomas Gieryn's (1983) demarcation of science from non-science. He described boundary work as creation, relocation, and strengthening of boundaries between science and other forms of knowledge such as religion in 19th-century Britain. He aligned it with the "attribution of selected characteristics to the institution of science (i.e. to its practitioners, methods, stock of knowledge, values and work organization) for purposes of constructing a social boundary that distinguishes some intellectual activities as non-science" (1983, 7–82). For Gieryn, boundary work explores the interrelation of boundary construction and social identity and belonging to a community. With his analysis, Gieryn highlighted how boundary work can be enacted as ideological means to expand and monopolize authority through distinction and separation. Originally applied for analytical purposes, it was subsequently adapted for research spanning and crossing disciplinary and professional boundaries. Donald Fisher proposed a more generic definition: "Boundary work is defined as those acts and structures that create, maintain and break down the boundaries between knowledge units" (1993, 13–14). It encompasses claims, activities as well as institutional structures (Klein 2021). Langley et al. define boundary work as a "purposeful individual and collective effort to influence the social, symbolic, material and temporal boundaries, demarcations and distinctions affecting groups, occupations and organizations" (2019, 704). They consider boundary work a practice that clarifies differences and enables connections. The authors further distinguish actions that aim at creating, maintaining, blurring, or transforming boundaries.

Other scholars followed, broadening the concept to include applications to inter- and transdisciplinary research. In transdisciplinary research and learning, boundary work further addresses not only characteristics of knowledge fields but also sectors of society, including positionality of all participants to elaborate on different objectives, roles, and tasks through negotiation of ethical-political chal-

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lenges in collaborative processes. In classifying the concept, Peter Mollinga (2010) identified three types of boundary work: (1) development of appropriate concepts of bordering, which allow us to address the multidimensionality of research; (2) configuration of adequate boundary objects as instruments and methods, through which incomplete and insecure knowledge, non-linearity, and diverging interests can be approached; and (3) creation of boundary situations where concepts, instruments, and methods can be explored in a profitable manner.

In addition, neighboring concepts relate to different dimensions and types of boundary work. Paulo Freire (1996), for example, aligned the concept with emancipatory and liberating pedagogy. He consideres "limit acts", drawing on Vieira Pinto (1960), as practices that expand perception and understanding of an existential situation people are experiencing and people *are* because they are "in a situation, … rooted in temporal–spatial conditions which mark them and which they also mark" (1996, 90). Limit acts are provoked by being challenged and reflect upon a situation. According to Freire, working on boundaries is where transformation happens. Sahr and Wardenga (2005) also locate this idea of boundaries playing a central role in understanding and appropriating the world in the origins of Geography as subject. According to Kant (cited in Hard 1993), Geography is the pre-exercise in knowledge about the world (German: *Kenntnis der Welt*) and a precondition of an understanding of the world (German: *Welterkenntnis*). It is in this formation of worldviews that the political character of boundaries brings itself to the fore. The common drawing of geographical boundaries that is anchored in polarities and an Aristotelian logic, however, is distinct to the boundary work this chapter highlights. Here, boundary work is introduced as a praxis of differentiating that brings forth connections while working in inter- and transdisciplinary research and higher education. A generic definition of boundary work consists of multiple practices related to differentiating, mediating, and negotiating different ways of knowing, acting, and being, thereby opening up conditions for joint thinking and collaboration or closing down options for co-work due to epistemological or value-based reasons. Boundary work is the praxis of making differences visible, utterable, and tangible to confirm, reinforce, transgress, transcend, or transform boundaries.

Background

Boundaries are a universal category. They are at the bottom of any formation of identity and social order. This generalization applies to the experience of the self brought to bear in forming standpoints and positionalities in the sense of locating ourselves in the world and belonging to it. Heintel et al. (2018, 1) consider boundaries, boundary demarcation, and transgression deeply internalized abstractions and actions. Nevertheless, as fundamental as the category of the boundary is, its

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character and constitution remain elusive. Whether boundaries are given, or processually brought forth, is the stuff big theories are made of (Vilsmaier 2018). Post-structuralist considerations have particularly informed theoretical discussion in recent decades, and shown that the ambivalence of the core concept of boundary defies clear definition. Redepenning draws attention to this ambivalence when emphasizing "boundaries are somewhat confusing [as] they limit 'something' *and* at the same time give us the instruction to overcome the limits of that 'something'" (2005, 168, own translation, italics in the original). Boundaries therefore always imply transgression. According to Cassirer (1994), boundaries can only be thought of as networks of relationships and processes that connect aspects of perception, expression, and action. Thus, bordering and ordering can be considered complementary categories (Sahr and Wardenga 2005). Every process involves acts of positioning and relationing that demarcate and transgress boundaries. While the concept of difference focuses on the one and the other, the concept of bounding shifts attention to a third process. Compared to the concept of border demarcation, bounding does not only describe demarcation but also the emergence and reconfiguration of boundaries. With his concept of Third Space, Bhabha (2004) introduces a topography that emerges from bounding and enables mediation of differences. Thereby, difference is considered a dynamic, or more precisely a diastatic, category that only comes into being in processes of differentiation (Vilsmaier 2018).

Boundaries are also at the bottom of the landscape of modern science. Disciplines only exist against the background of other disciplines they separate from. In this act of separation, Hamberger (2004) sees a transdisciplinary momentum in any discipline and Bhabha (2006) considers boundaries between disciplines as barriers to transverse or transcend when entering interdisciplinary inquiries, and at the same time "liminal forms of definition". The ambiguity of boundaries is apparent within inter- and transdisciplinary research, teaching, and learning. Boundaries between disciplines or specialized fields of knowledge structure institutionalizing distinctions as while multiple forces drive us to transgress them. We draw our professional identities from limited fields that allow us to develop a standpoint, while at the same time seeking to transcend them. Often, the impossibility of fully grasping a phenomenon from different disciplinary perspectives drives us towards boundaries.

Yet becoming aware of boundaries prompts acting upon them (Freire 1996). What matters most here is different dimensions of reference from which we attend to boundary work. This imperative is central to boundary-spanning and boundary-crossing research, allowing us to understand underlying conceptions of boundaries. Of added significance, it is crucial to consider whether boundaries are conceived as stabilizing or narrowing entities from the perspective of differentiation or from a performative conception of boundaries. The distinction

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pertains whether one strives towards fixating the separating elements (A and B, such as two different disciplines) as a basis of creating connections, or whether commonalities, differences, overlaps, and intersections bring forth C that not only includes but also modifies A and B. The focus is therefore on either objects or entities (e.g. disciplines) or subjects or people (e.g. researcher). If phenomena or problems require alteration of historically developed processes of ordering, of a shift or even demolishing of boundaries, this added caveat also requires attention to institutional practices and professional identities. When critiqued, what is known, customary, established, or unquestioned can hence shatter or weaken a supposedly sound terrain, or conversely be vindicated and open up to transgressing boundaries (Vilsmaier 2018).

Debate and criticism

Despite the popularity of inter- and transdisciplinarity and neighboring boundary-spanning and boundary-crossing forms of research, boundary work still receives little to no systematic attention. Transdisciplinary forms of research and learning are often more celebrated than they are founded epistemologically and conducted methodologically. Thus, they are not only vulnerable to attack but also prone to fail to transgress boundaries, integrate knowledge, or unfold transformative potential. A solid understanding of the kind of boundary spanning or crossing in research, teaching, and learning is key for conducting boundary work that enables mutual understanding of existing boundaries and also whether and how to work productively on these.

A recent book placing boundary work at the heart of inter- and transdisciplinarity brought together prior and new recognition of its centrality while extending implications (Klein 2021). Boundaries have a dual function: they demarcate different forms of expertise but are permeable and contingent as well, leading to both difference – in images of turf and territory – and interaction – in biological images of cross-fertilization. The two underlying metaphors, though, do not constitute a dichotomy. They operate simultaneously in the composite concept of an ecology of spatializing practices, illustrated by the evolving nature of disciplines as well as enclaves of trading zones and communities of practice. Thus, boundary work entails navigating and negotiating existing divisions as well as catalyzing new enclaves, while also bridging sectors of the academy, government, industry, and communities. Updated descriptions of disciplines also acknowledge their porous nature. Openness to change, however, is uneven, and lack of familiarity with inter- and transdisciplinarity limits prospects for transformational change. Michael Foucault (1995) stipulated boundaries that prescribe social order, and dualisms of normality and deviance, as well as belonging and not-belonging. In that sense, a boundary clas-

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sifies, categorizes, sorts, segments, and normalizes. It also includes and excludes, privileges and de-privileges. Yet boundary remains uncrossed. Moreover, boundaries are contested and their authority is disputed. The boundary rhetoric of both inter- and transdisciplinarity, then, is complex: it "compasses acts of spanning, crossing, and bridging; processes of interacting, integrating, and collaborating; strategies of brokering, mediating, and negotiating; operations of demarcating, constructing, and refiguring; new relations of interdependence and convergence; and outcomes of breaching, transgressing, and transforming" (Klein 2021, 22–23).

Methods of boundary work support systematic approaches to elaborate on differences while differentiating and thereby laying the ground for integration (Vilsmaier 2018). The term method encompasses different types of proceedings. Methods of boundary work serve multiple purposes, ranging from creating conditions for shared thinking and acting by creating understanding for one's own and others' standpoint and positionality, support problem framing and mutual learning, and, depending on the types of research, theoretical or methodical integration or product development. They often deploy a related concept highlighted in this chapter: boundary objects. According to Star and Griesemer, who introduced the concept in 1989 in the field of Science and Technology Studies, boundary objects "are both adaptable to different viewpoints and robust enough to maintain identity across them" (1989, 387). Boundary objects can mediate between different social worlds: "They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable means of translation" (Star and Griesemer 1989, 393). The authors distinguish between repositories, ideal types, coincident boundaries, and standardized forms. Bergmann et al. broadened the meaning of boundary objects for practices of integration in transdisciplinary research. The concept is applied to all sorts of "interfaces where actors from different fields, such as science, politics and business, meet and communicate" (2012, 105). Deployed as integration methods, different entities play out as boundary objects, such as artifacts, products, abstract ideas, common research goals, illuminating examples, or publications (Bergmann et al. 2012).

In methods of boundary work, boundary objects first and foremost serve the elaboration of differences. Peukert (2022) experimented with design prototyping as boundary work, using prototypes as boundary objects in transdisciplinary research. The dual characteristic of process character and object status could be identified as a particular quality of prototyping. Working with highly diverse research participants in a case study in rural Romania, language of form of prototypes and common abilities in constructing and modifying these turned out to be a powerful way of navigating differences and unequal means of conceptual expressions (Peukert et al. 2020).

Conceptual work is an elementary form of boundary work in transdisciplinary research. The more heterogeneous a research team, the more likely that the same

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concepts carry different meanings in different social worlds. Boundary concepts are key means of making connections. They are semantic anchors for developing coherent research frameworks and meaningful results that exhibit communicative, epistemic, and ethical–political dimensions. Conceptual work aims at creating mutual understanding for different semantics and roles of concepts in a research field, as well as negotiating the use of concepts. However, the process is often not explicitly placed within research processes, leading to difficulties (Hoffmann et al. 2017). Many technical terms are used in everyday language and mutual understanding is often presumed, but without exploring their meaning (Bergmann et al. 2012). These tendencies can become obstacles showing the paradoxical nature of such concepts. Quotidian usage of terms can be made productive for communication, but semantic differences are too easily glossed over (ibid. 2012). Conceptual work, however, is by no means limited to academic clarification of meanings. It has a significant political dimension where disciplinary or, more generally, scientific hegemonies and inequalities in conceptual abilities may easily play out. Here, conceptual work as boundary work has the potential to create visibility not only for different semantics of terms but also for differences amongst collaborators. In that sense, conceptual work can be defined "as the collaborative process of clarifying the meaning and use of concepts across disciplines and epistemic cultures, developing mutual understanding and balancing power inequalities amongst participants in order to support knowledge co-creation" (Juarez-Bourke and Vilsmaier 2020, 25).

Current forms of implementation in higher education

Boundary work draws on difference. In higher education, it is particularly useful when guiding students from different study fields. Multi-, inter-, and transdisciplinary classrooms present great opportunities for boundary work. Experiencing, exploring, and systematically approaching different perspectives and ways of acting upon a given problem, boundary work equips students with abilities and techniques to elaborate on and integrate different knowledges or practices. In research on environmental science education, Fortuin (2015) further distinguishes boundary-crossing skills from inter- and transdisciplinary cognitive skills and reflexive skills. Boundary-crossing skills should equip students to (1) be aware of different disciplinary, cultural, theoretical, and practical perspectives; (2) acknowledge the values of using these perspectives in addressing complex problems, and (3) use various disciplinary perspectives and connect them, to collaborate, negotiate, make decisions in intercultural settings, and deal with complexity and uncertainty (Fortuin 2015, 133).

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To illustrate: in a student-driven transdisciplinary research module, conducted over several years in a Master's program of sustainability science, different forms of boundary work were applied to train students in boundary work on three levels (Vilsmaier and Lang 2015). (1) On the *personal level*, students explore and elaborate their professional profiles and identities related to their study fields. This kind of boundary work departs from the perception of others' professional characteristics. For instance, a sociologist provides a description of his or her imaginary of a sustainable chemist and vice versa, thereby laying bare often glossed over assumptions, supporting reflection and building self-awareness of the student's specialization. The process aims to uncover assumed positions from which a research or study subject is approached. Thereby, not only abstract systems of knowledge. Individual configurations of the same unfold, helping visualize researchers' positionality with regard to their situatedness within knowledge fields, paradigms, and personal situated accounts that inform study and research (Rose 1997). Within transdisciplinary research and learning, this procedure also takes on cultural and social situatedness while taking values and norms into consideration (Rosendahl et al. 2015). Boundary work allows for visualizing situated relations of researchers or learners with each other (Klein 2010). (2) On the level of *knowledge fields*, students explore their study fields by developing topographies of knowledge fields with regard to core topics, dominant theories, and common methods. Based on individual maps, student teams elaborate on commonalities while exploring differences. As a result, a map of the student team is developed that provides insights into the team's expertise, abilities, and perspectives. Already at this stage an interdisciplinary in-between space shapes and serves as a starting point for collaborative research. (3) On the level of *societal domains*, boundary work includes elaboration of differences with regard to roles, responsibilities, interest, and objectives in a transdisciplinary team. At this level, students enter the constitution of a transdisciplinary in-between space that emerges from difference (for more details see Vilsmaier and Lang 2015).

Didactical approaches that prepare students to deal with the complexity they will face conducting transdisciplinary research must pay particular attention to a *literacy of difference* – supporting students in reflecting on their own positionality and in developing an attitude of openness for mutual learning.

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