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From Interdisciplinarity to Postdisciplinarity: Extending Klein's Thinking into the Future of the University

by

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Abstract: Complexity is among the main drivers that justify and guide the genesis and establishment of multi-, inter- and transdisciplinary approaches to the production and application of knowledge. Complexity can be read in the relatively canonical taxonomy of these concepts that structure epistemological reflections on the dynamics of knowledge production lying between and beyond disciplinary boundaries, a taxonomy that Julie Thompson Klein and other leading interdisciplinarians have proposed. The introduction of the concept of postdisciplinarity into this conceptual evolution allows for further reflection on more or less likely scenarios for the development of university institutions, scenarios more or less transgressive of the disciplinary status quo. These possible epistemological and institutional mutations would require actors who are cognitively available and open to change, or even frankly "undisciplined," with the goal of transforming academic institutions into the university of the future by fostering breakthrough innovation.

Keywords*:* complexity, interdisciplinarity, Julie Thompson Klein, postdisciplinarity, scenarios, transgression

> *We are not students of some subject matter, but students of problems. And problems can be cut right across the borders of any subject or discipline.*
>
> Karl Popper

> *We can't solve problems by using the same kind of thinking we used when we created them.*
>
> Albert Einstein

1. Introduction

Interdisciplinarity has become a concept that has the wind in its sails and that seems to promise a bright theoretical and practical future. It innervates institutional discourses that employ it as a slogan and/or more seriously as a strategic vision. The call for interdisciplinarity and/or transdisciplinarity is heard in higher education and research organizations at national, European, and international levels. Numerous academic policy reports in this area, succeeding each other, are relatively similar, offering more or less innovative reflections and recommendations. Research funding agencies also promote interdisciplinarity and/or transdisciplinarity, even making one or both a requirement in the submission of projects aimed not only at advancing basic research, but also at solving complex problems (environmental, social, political, technological, etc.). The implementation of interdisciplinarity has sometimes been crowned with success but not without provoking debates and encountering obstacles, evoking resistance or anxiety among people who have taken the risk of leaving their discipline to do interdisciplinary work. If interdisciplinarity is accepted as important, it should not (or no longer) be taken for granted and considered as a practice that does not require specific study. This would be to ignore the many scholarly works that do study the issues of interdisciplinarity in its institutional, epistemological, theoretical, methodological, and practical dimensions. Within this field of inter- and transdisciplinary studies, the expertise of Julie Thompson Klein is widely recognized by the interdisciplinary academic community. In this article, I will draw upon her expertise, not to reconstruct the origins, content, and trajectory of her pioneering, significant, inspiring, and promising work, nor to offer the long and hagiographic tribute of which she is so highly deserving, but to try to discern some reflections from her work that might help us envision the future of the university – perhaps a postdisciplinarity future.

In what follows, I discuss several lines of thought in a complementary way. Firstly, I return to the motivations and drivers of the genesis and progressive establishment of interdisciplinarity and transdisciplinarity as an apparently pre-eminent perspective in the production of knowledge in a complex and uncertain world. The central and powerful argument that complexity invigorates and justifies the discourse on inter- and transdisciplinarity is specifically highlighted. Secondly, I return to the relatively canonical definitions of the main concepts/approaches of multidisciplinarity, interdisciplinarity, and transdisciplinarity. From there, I attempt to discover whether such a taxonomy is likely to be able to take into account newly emerging trends, such as

postdisciplinary research. Can the concept of postdisciplinarity be simply integrated/assimilated into the existing taxonomy, or does it offer a radically different and unusual perspective, in the sense that it frees itself from any disciplinary reference? From that point, I outline possible development scenarios in universities wishing to promote interdisciplinarity, transdisciplinarity, and even postdisciplinarity, though they may remain epistemologically and institutionally programmed (disciplinarily organized) to resist this change. This discussion of openness to more or less likely academic futures in the short, medium, and long term finally raises the question of the identities and specific capacities of the actors (teachers, researchers, academic leaders, etc.) who wish to be agents of change in favor of inter- and transdisciplinarity, or even more radically, of postdisciplinarity, within a context of development, innovation, and discovery. To explore these lines of thought, I freely build upon Julie Thompson Klein's work in relation to these issues (see in particular Klein, 1983, 1990, 1996, 2004, 2010a, 2014), while linking them with references to other authors, as well.

2. Drivers of Interdisciplinarity: Complexity First

2.1. Convergent Drivers against Disciplinary Dominance

The production of knowledge has always oscillated between centripetal cognitive, theoretical, and organizational forces that aim at disciplinarizing the study of restricted subjects and, inversely, centrifugal forces that promote interdisciplinary and transdisciplinary academic decentration. Historically (Klein, 1990), the discourse on interdisciplinarity that has fueled centrifugal forces pushing beyond disciplinary limitations has been characterized by the desire to study complex issues/problems and solve them by employing several disciplinary points of view, while exploring the relationships and convergences among insights derived from different disciplines and professions. Beyond local or national variances, and the many forms that interdisciplinary work can take, the call to interdisciplinarity has energized the fields of natural and life sciences and technologies, as well as the humanities, social sciences, arts, and culture. This call for interdisciplinarity is not just a rhetoric of promotion; it is motivated by some views widely shared across academic communities, professional and political organizations, university administrators, and research funding agencies (König & Gorman, 2017; Klein, 2018).

Among the many possible motivations for embarking on the interdisciplinary path, there is agreement that we should recognize four major driv-

ers for doing so, as formulated in the US-based National Research Council report (National Research Council, 2005). This report, often referenced in interdisciplinary literature, including Julie Thompson Klein's publications, identifies these drivers as follows: 1. The inherent complexity of nature and society; 2. The desire to explore issues not confined to a single discipline; 3. The need to solve societal problems; and 4. The need to produce revolutionary insights and generative technologies. The argumentative force of these four drivers lies in their interdependence and coherence. The endogenous complexity of problems of different types (scientific, environmental, social, political, cultural, etc.) – problems that are necessary or even urgent to solve – makes it impossible to apply a strictly unidisciplinary approach to solving them, and joins the desire to explore beyond arbitrary boundaries between disciplines with the need to do so. By responding to these drivers 1, 2 and 3 and relying on the accelerating and transformative power of new information and communication technologies, researchers are likely to produce revolutionary ideas for problem solving by transgressing existing disciplinary paradigms.

These convergent drivers pose a serious threat to the seemingly well-stabilized disciplinary university structure and challenge disciplinary hegemony (Henry, 2005). In response, the drivers of disciplinarity can be (and have been) inversely formulated as an anti-interdisciplinary force and promoted as the primary means of knowledge production. Proponents of disciplinarity do not consider (or are blind to) complexity, or deal with only one dimension of this complexity. They are driven by a desire to focus on a single issue, a problem or sub-issue clearly defined within a larger set. They also do not try to rethink their disciplinary practice to solve concrete problems outside the academic field. They act primarily to ensure reproduction and durability of their own disciplinary community. And they have been successful. In spite of the argumentative force of drivers in favor of interdisciplinarity and the many advances in this field, it must be acknowledged that the disciplinary model is still dominant, recognized and valued in universities. The obstacles repeatedly encountered in attempts to implement interdisciplinarity are a testament to this persistence of disciplinary hegemony: the prevalence of the disciplinary organization/institutionalization of knowledge, the priority and symbolic power attributed to the disciplinary career, and the disciplinary bias in evaluating interdisciplinary research and publications, etc.

2.2. Complexity and Interdisciplinarity

The notion of complexity as the first driver or trigger of interdisciplinar-

ity is of central importance as a founding prolegomenon of interdisciplinary thought. If complexity is properly regarded as a preliminary concept that motivates and justifies the use of interdisciplinarity, it is then likely to lead to a redefinition of the nature of knowledge as going beyond the partitions between disciplines. To think in a complex way is to change one's way of thinking in terms and disciplines and to realize that complexity is at work in multiple bio-psycho-social systems, crossing the boundaries between disciplines. Although their historical affiliations are relatively different, the concepts of interdisciplinarity and complexity converge at many points (Jantsch 1972; Klein, 1990-91, 1999, 2004; Klein & Newell, 1998; Newell, 2001; Repko, 2008). They come together in their epistemological positioning against the atomization or, conversely, the unification of knowledge; they are on the contrary in favor of the reorganization of the diversity of knowledge in ways that supersede the disciplinary and institutional frameworks that insist on divisions between the natural sciences, social sciences, and humanities. Interdisciplinarity and complexity are powerful antidotes to both reductionism that disjoins interdependent elements and holism that merges them without considering their productive diversity (Le Moigne, 2008). Both promote articulation of what is separate and connection of what is disjointed by means of cognitive and practical integration devices. Faced with the discrepancy among the elements of a complex system, as well as among the disciplines that study it, it is necessary to favor the "reliance" (Morin, 1996, 2005) that, instead of disjoining, reducing, and unidimensionalizing, makes it possible to distinguish without disjoining, to associate without reducing. Any complex system can be conceived as *unitas multiplex* (unity/multiplicity in diversity and diversity in unity/multiplicity); such a system oscillates between a homogeneous tendency to organize its elements into a coherent whole and a heterogeneous tendency to highlight the specificity of each constituent element (Klein, 2001).

A system is a whole unit that emerges from the constant interaction among its constituent elements (Morin, 2005). This vision of complexity or systemic thought is inter- or transdisciplinary in the sense that it applies in many disciplines: From philosophy to physics, sociology, psychology, biology, environmental studies, etc., each system (cognitive, natural, social, biological, etc.) is defined as an assembly of heterogeneous elements irreducible to only one of them. To take note of this inherent complexity of any subject, object, or problem, and to make it a principle of epistemological vigilance, is to guard against any anti-interdisciplinary attempt to ignore the elephant in the room. The strictly disciplinary (and seriously limited) vision considers more or less consciously only a sub-part of a complex thing by artificially

isolating it from everything to which it is nevertheless directly related. This epistemological stance, often propounded as academically correct, amounts to refusing to admit the obviousness of complexity; to move from the pachydermic metaphor to another, it makes complexity a taboo subject by urging one to bury one's head in the sand and ignoring the need for more systemic and interdisciplinary thinking.

Interdisciplinarity and complexity are, then, two intertwined notions: Taking into account the complexity of an object of study requires an interdisciplinary approach and, inversely and in a complementary way, any interdisciplinary approach conceives its object of study as complex. This fundamental epistemological lesson in the relationship between a multidimensional observant subject and a multidimensional observed object involves rethinking a series of tenacious dualisms: between unity and diversity, homogeneity and heterogeneity, whole and parts, order and disorder, etc. This dialectical tension between seemingly opposing terms (and referents) crosses rhetorical discourses on the complexity of knowledge (Klein, 2004). By going beyond this contradiction/tension between opposing and yet inseparable notions, the *dialogical principle* (Morin & Le Moigne, 1999) makes it possible to join these antagonistic notions and use them to think about the complex process of knowledge production. It is a question of discarding the strictly monological, analytical, and Cartesian perspective that tends to mutilate the inherent complexity of scientific, social, environmental, political, and cultural issues. In the same dynamic, the *principle of recursion*, according to which the object of knowledge produces the subject who produces it through a series of positive feedback loops, reinforces the idea of an epistemological coherence between the posture of the observant subject and the complex nature of the observed object. Finally, a *hologrammatic principle* posits that the part is in the whole and the whole is in the part (for example, the individual is in the society and the society is in the individual): The whole and the parts of a complex system are not opposed; they are interdependent and co-produce each other. The full awareness of these three convergent principles makes it possible to resituate the idea of disciplinarization, which often – under the pretext of scientificity and objectivity – omits complexity. However, it is by understanding and accepting the principles of complex thinking that disciplinarity can be located and rethought in its relationship to interdisciplinarity (and transdisciplinarity), and even more so in relation to the newer concept of postdisciplinarity.

3. What Place for Postdisciplinarity?

3.1. Disciplines et cetera

Interdisciplinarity does not seem to be defined or definable outside the basic idea of disciplinarity, the historical and semantic foundation from which it takes meaning through continuity and differentiation. The fundamental link between disciplinarity and interdisciplinarity lies at the heart of the definitions of these concepts, definitions that reflect the range of their complementary and antagonistic relationships, a range encompassing inclusion, attraction, repulsion, association, dissociation, integration, and disintegration. The dense semantic network of concepts that reflect disciplinary decompartmentalization includes: monodisciplinarity, multidisciplinarity, alterdisciplinarity, intradisciplinarity, paradisciplinarity, supradisciplinarity, metadisciplinarity, transdisciplinarity, etc. Scholarly literature on interdisciplinarity is full of concepts with more or less attractive sounding names, and lexical creativity in this area is not lacking, although these terms do share the central notion of a disciplinarity that an open series of prefixes modulates/transforms on a case-by-case basis. In spite of debates that have engaged a whole community of researchers, a few of these concepts have come to be broadly accepted in synthesis work on interdisciplinarity: multidisciplinarity, interdisciplinarity and transdisciplinarity.

This terminological triad represents the main taxonomy for thinking about the degree of interaction and integration among disciplines in a collaborative dynamic (Klein, 2010a). Although it is now commonplace, a topos widely disseminated in interdisciplinary studies, it is also important not to stop there but to consider this taxonomy from an evolutionary perspective. Like any taxonomic approach (Klein, 2010a), its purpose is to identify and describe the organization of knowledge at a given moment, to name and group its constituents under a set of provisional definitions. The emergence of new knowledge production practices, methods, theories, or academic fields is likely to raise questions about the accepted terminological classification, and extend or even transform it. We shall see below how considering the concept of postdisciplinarity is likely to bring about a change in the taxonomy most interdisciplinarians have been using for many years now.

It should be noted at this stage of the reflection that the concept of disciplinarity itself is surprisingly often ignored, as if its definition is self-evident as the obvious (and unquestioned?) foundation of university organization and of knowledge itself. However, I think it appropriate to define it initially and then to fix, through successive differentiations, the triad of related concepts involving versions of interdisciplinarity identified above, in preparation for

final consideration of the concept of postdisciplinarity, gateway to a possible future of transformation in the academy and the wider world, as well. This definitional section of the article, essential to properly situating the concept of postdisciplinarity, is obviously inspired by the typological work of Julie Klein (2010a) and directly echoes my own work, too (see in particular Darbellay, 2005, 2015, 2016) and that of many others (see Jantsch, 1972; Piaget, 1972; Huutoniemi, Thompson Klein, Bruunc & Hukkinena, 2010; Rosenfield, 1992; Stokols, Hall, Taylor & Moser, 2008). It is not a question here of formulating a new typology, but simply of proposing a clear and articulated definition of the key concepts.

The terms of disciplinarity, multidisciplinarity, interdisciplinarity and transdisciplinarity can be defined as follows:

- *Disciplinarity*: In a classical perspective, any discipline is the result of a process of institutionalization/standardization of research and teaching practices specific to an academic community, socially and historically situated and governed by a paradigm that defines the hypotheses, objectives, theories, and methods from which scholars build knowledge. Disciplinarizing therefore involves the institutional juxtaposition of several communities of specialists, divided into faculties, departments, and autonomous laboratories. The specialization of knowledge, through the many attendant approaches, epistemological postures, languages, and disciplinary methods, fragments the objects of study into disjoint parts. These communities of specialists are plunged into academic isolation, blocking any possibility of interdisciplinary dialogue.
- *Multidisciplinarity*: In multidisciplinary work, an object of study, a theoretical subject or a practical problem to be solved, is approached from the perspective of at least two disciplines. This practice has the advantage of plurality, but nevertheless organizes the different disciplinary approaches in an additive logic of succession that generates a juxtaposition of disconnected points of view without integration among them. There is an openness to epistemological pluralism, but nevertheless the practice fits into the continuum being discussed close to disciplinarity insofar as it confirms institutional compartmentalization in disciplinary communities that remain governed by their own academic paradigms, theories, and internal methods.
- *Interdisciplinarity*: This approach mobilizes at least two disciplines by articulating them dynamically; it entails describing, analyzing, and understanding the complexity of an object of theoretical or practical study irreducible to a monodisciplinary approach. Inter-

disciplinarity, which goes beyond the multidisciplinary juxtaposition of different disciplinary points of view, involves a collaborative and integrative endeavor associating insights from two or more disciplines around a jointly defined object. Collaborative interaction and integration among disciplines can occur in different ways, for example, through transfer or borrowing of concepts or methods, through crossing or hybridization mechanisms, or even through creating new areas of research by combining two or more disciplines. As indicated by the prefix *inter-*, the production of knowledge is played out among the disciplines, in what circulates among them, at the interface, in their interstices. The result is not the mere juxtaposition of disciplinary insights that multidisciplinarity provides, fragmenting complexity by disjunction, but instead a new conjunction of cognitive, conceptual, theoretical, and methodological fragments in a coherent and intelligible whole. Collaborative and integrative endeavor are most often institutionalized through the establishment of interdisciplinary structures at the interface of several faculties in the university system. These structures (interdisciplinary centers, platforms, etc.) offer space-time dedicated to interdisciplinary work.

- *Transdisciplinarity*: The concept of transdisciplinarity covers different and complementary orientations. In a first orientation, transdisciplinarity refers to a process of knowledge production that goes beyond disciplines, or transcends disciplinary boundaries, involving a reconfiguration of those boundaries in a systemic, global, and integrated perspective (transdisciplinarity as "discourse of transcendence," as described by Klein, 2014). In a second orientation, a more pragmatic, participatory, and applied approach, transdisciplinarity can be considered as a research method bringing together political, social, and economic actors as well as ordinary citizens in the research process itself, in a dynamic of problem solving (transdisciplinarity as "discourse of problem-solving," cf. Klein, 2014; Klein et al., 2001). Platforms for exchange and dialogue between academia and society make it possible to establish this bridge between researchers and citizens, using transdisciplinary methods. In a third orientation, transdisciplinarity also applies to the exploration of complex relationships woven into the transcultural dialogue between academic cultures from the technical, life and natural sciences, social sciences, and humanities. Projects, structures, and devices at the interface of these cultures allow mutual learning be-

tween researchers with different epistemological horizons. Klein (2014) also considers a fourth trend of transdisciplinarity (the "discourse of transgression") that is more critical of the existing system of knowledge organization and educational stakes that underlie it. I return below to this idea of transgression in that, beyond the fact that it can characterize one of the orientations of transdisciplinarity, it carries with it a transformative potential relevant to a possible postdisciplinary path.

The clarification of these four concepts inherent to the discourse on interdisciplinarity shows the progression of and interconnections between the complexity levels of the links between the academic disciplines involved in an interdisciplinary endeavor. From multidisciplinarity to interdisciplinarity and transdisciplinarity, there is an epistemological dynamic that roots these different but complementary approaches in a disciplinary base from which a network of relations grows that is increasingly dense, interactive, and integrative. Disciplinarity remains the epistemic foundation on and from which multi-, inter- and transdisciplinary approaches to problem solving are built to stand at varying distances from the idea of disciplinary dominance.

3.2. Postdisciplinarity: Future Scenarios

The term "postdisciplinarity" is less common in the field of interdisciplinary studies than the terms defined above, and is perhaps less widely accepted and disseminated because it carries a transformative claim on the organization of disciplinary knowledge, its institutionalization, and the concomitant hierarchical relationships that structure academic institutions. This much less accepted stance towards the disciplinary status quo – unlike the multi-inter-transdisciplinarity that is based on the idea of disciplinarity – gives rise to some fear, or at least caution, on the part of interdisciplinary actors who do not wish to confront the dominant disciplinary scenario. Postdisciplinarity opts for a more militant critical discourse against disciplinary rigidities, and calls for a redefinition of the partitions between the disciplines, and even the very notion of disciplines (Klein, 2005, pp. 60-62). As noted earlier, in the terms "multi-," "inter-," and "transdisciplinarity," the prefixes all designate a relationship with the disciplinarity foundational to them. In a more provocative way, the prefix "post-*"* in "postdisciplinarity" opens a horizon of knowledge that comes after the disciplines. The prefix "post-" expresses a state of posterity whose interest lies precisely in how it has shaken definitional taxonomy with regard to the relationship between disciplinarity and non-disciplinarity or even anti-disciplinarity (Darbellay, 2015, 2016), calling for epistemic disobedience versus acceptance of established knowledge (Ings, 2016).

Of course, the discourse of transgression, as identified by Klein (2014) in discussing transdisciplinarity, is also characterized by the desire to question the simple reproduction of dominant practices and to reinvent the ways of thinking and doing research. And, in this case, the prefix "trans-," like the prefix "post-," is also used to designate so-called "post-normal science" (Funtowicz & Ravetz, 1993). The arguments underlying this kind of transdisciplinarity (involving interdependence and intersectoriality of social problems, complex relations, non-reductionism, irreducibility to a single discipline, etc.) are very close to those guiding the discourse of problem solving, and they similarly question the limits of disciplinary approaches. But they don't make people as nervous, perhaps because they don't seem sufficient to radically challenge the disciplinary foundations of knowledge production processes. In the same vein, the useful and beneficial distinction that can be made between two kinds of knowledge, mode 1 (hierarchical, homogeneous, disciplinary, "reliable scientific knowledge") and mode 2 (contextualized, complex, non-linear, heterogeneous, transdisciplinary, "socially robust knowledge") (Gibbons et al., 1994; Nowotny, Scott, & Gibbons, 2001), invokes dichotomies to transgress boundaries and foster new partnerships between academia and society. But does it go further and transform thinking on the dichotomy between disciplinarity and inter- and transdisciplinarity in ways that can be seen as transgressive?

Granted, the idea of transdisciplinarity has been seen as transgressive insofar as it promotes critical approaches to knowledge production and problem solving that question the limits of a one-dimensional vision (Klein, 2014). Cultural, postcolonial, and gender studies have challenged notions of class, gender, race, ethnicity, and identity, highlighting the complexity of these issues and arguing for transcendence of disciplinary boundaries in dealing with them. This questioning of disciplinary conventions and the institutional straitjacket they entail has been accompanied by strong insistence on the principle of responsibility from a human rights perspective, recognition of the value of secular and not just academic knowledge, and increased democratic participation in solving social, political, and environmental problems (Klein, 2014). The discourse of transgression clearly highlights the inability of an imperialist monodisciplinary vision to address such concerns and rightly criticizes the institutionalization of disciplinarity and hierarchies among disciplines, involving relations of power or prestige among them. But is this critical form of interdisciplinarity capable of radically altering the persistent tension between disciplinary restraints and inter- and transdisciplinary openness?

The notion of postdisciplinarity offers some usefulness in this discussion, if it is not thought of as merely (or nearly) synonymous with inter- or transdisciplinarity. We would argue that "postdisciplinarity" is not simply another term to be added to the conceptual taxonomy discussed above in a logic of progressive de-and-re-construction of the disciplinary conventions, but is, on the contrary, a term that reverses perspective by radically challenging the need for a disciplinary foundation in the process of producing knowledge. This vision of a strong postdisciplinarity would not preserve the identity of the disciplines and the disciplinary organization of knowledge. In this respect, it would distinguish itself from the milder and more moderate accepted forms of multi-, inter- and transdisciplinary practices. Transgression is understood here to involve a truly transgressive lack of respect for the disciplines and the institutional logics that legitimize and protect them, as well as the obligation to assign to others or to oneself a fixed disciplinary identity.

In a forward-looking and intuitive approach, we can attempt here to open a field of reflection on the current reality and possible future of a more or less truly transgressive postdisciplinary approach, given the disciplinary organization of academic institutions that for now retains its dominance and its prevalence. By considering postdisciplinarity as a form of knowledge production that potentially differs the most from those based within and on disciplines, one can dialectically relate postdisciplinarity to disciplinarity. Figure 1 below describes a variably strong postdisciplinarity (i.e. a variably marked degree of rupture with respect to disciplinarity) and, conversely, a variably strong disciplinarity, ranging from one firmly maintaining disciplines to one allowing their progressive decompartmentalization or even their disappearance. To each level of disciplinary organization corresponds a postdisciplinarity that is more or less capable of subverting or even transforming the disciplinary principle. Deriving from this differential coupling between seemingly antagonistic perspectives, four heuristic scenarios can be briefly identified. For a more detailed presentation and discussion of these scenarios, I refer readers to my contribution (Darbellay, 2019) to the collaborative work *Postdisciplinary Knowledge* (Pernecky, 2019) that presents philosophical, theoretical, and methodological perspectives on postdisciplinarity in research.

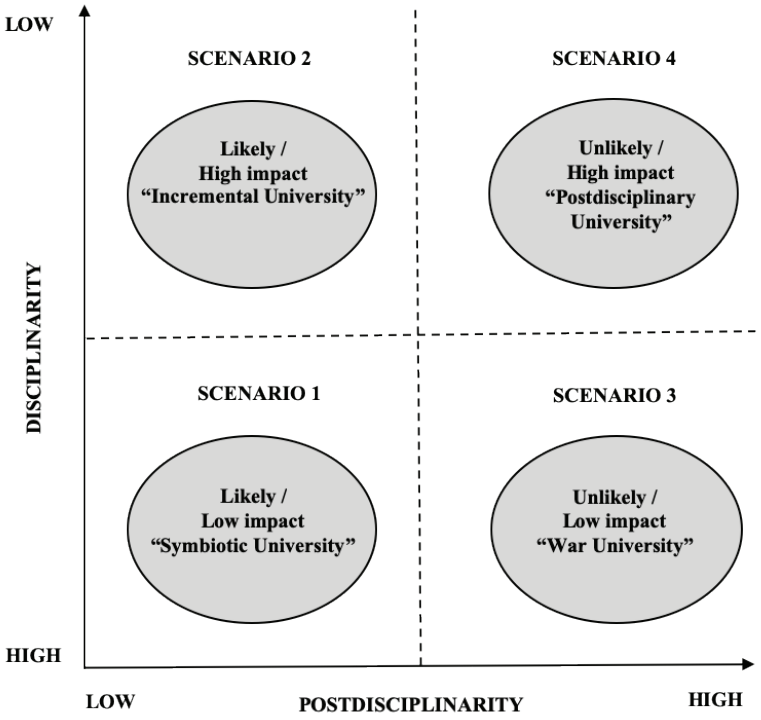

Figure 1. Scenarios

Scenario 1 (very likely, even current, and with very low transformational impact on the disciplinary system) involves a high level of the disciplinarization of knowledge characterizing academic institutions, with a weak form of postdisciplinarity. The disciplines represent the basic building blocks from which new approaches are built: Postdisciplinarity here corresponds to the multi-, inter- and transdisciplinary approaches that yield academic advances, but do not imperil the disciplinary model on which they rely. There is coexistence – without mutual exclusion – between disciplinary approaches and multi-, inter- and transdisciplinary approaches, resulting in a "symbiotic" relationship (Walklate & Richards, 2012; Repko, Szostak & Buchberger, 2017) that is neither transformational nor critical.

Scenario 2 (likely and ongoing with a possible gradual impact on discipli-

narization) continues the logic of scenario 1: The decompartmentalization of disciplinary boundaries, characteristic of a gradual weakening of the level of disciplinarity, triggers a process of incremental change that progressively transforms disciplinary configurations, without disrupting the disciplinary model. The disciplines' progressive transformation improves the system of knowledge production but without carrying out a radical questioning of its foundations. Disciplinary conservatism remains, but innovations within and among disciplines are possible, allowing evolution through contact and circulation of ideas, theories, and methods. In such a scenario, any discipline is likely to change through inter- and transdisciplinary dialogue; it is itself a heterogeneous construct subject to a greater or lesser variation under the impulsion of exogenous forces or forces of internal diffraction due to the diversity of schools of thought that constitute it. This dynamic tension involving disciplinary openness and possible change due to diversity of subdisciplines and contact with other disciplines is reflected in particular in hybridization processes that create new approaches to knowledge production – and even new disciplines, as well (Klein, 1983).

Scenario 3 opens up a different path and a much less peaceable one insofar as its postdisciplinarity is displayed in a demand for an in-depth redefinition of the disciplinary system or even its substitution by an alternative system yet to be defined, a demand that risks open conflict with the persistence/resilience of a high level of disciplinarization. In response, disciplinary conservatism is then expressed in the corporatism of "academic tribes" (Becher & Trowler, 1989) who withdraw themselves, refuse any constructive dialogue, and "declare war" on any initiative that might call into question the primacy of the disciplinary principle and the authority of the bodies that institutionalize it. Planned incommunicability, deaf dialogue, and epistemological and institutional blockages outweigh the dynamics of change. Discourses against inter- and transdisciplinary initiatives are customary, reflecting these anxiogenic and warlike attitudes. Although this warrior scenario is persistent, it is probably not sustainable, as it presents in the medium and long term little of value for those in the opposing camps.

In a spirit of openness, cooperation, and co-production, based on a low level of disciplinarity, scenario 4 represents an alternative marked by a strong postdisciplinary vision in a context that favors change that might be of value to all. This "anti-" or "adisciplinary" epistemological stance calls for radical innovation strategies, disrupting disciplinary logic by transgression and, indeed, revolution. This pathway, promising a strong transformative impact on the disciplinary system, may not take us far in the medium term, given the slow rate at which academic institutions evolve, but it lets us

contemplate a possible epistemic horizon, helping us to imagine the future and push towards it. In this scenario, the notions of disciplines, boundaries, etc. would no longer make sense, and we would have to invent new ways of thinking both individually and collectively. While pursuing the development and deepening of interdisciplinary and transdisciplinary approaches, we would also be acting to eventually enable the more disruptive models of an utterly altered academic system that the DNA of the current system seems to forbid.

As you will have understood, this brief outline of scenarios proposes more or less compatible visions of a redefinition of the disciplinary model with which most can align themselves, envisioning what is current and likely or possible in the short, medium, and long term. It allows us to consider past and present situations in which interdisciplinary studies have developed along with successes, limits, and resistances, but also to imagine possible alternatives to the persistent status quo, or even to think the unthinkable. Although scenario 1 now seems to dominate in the university context, the sequence of different scenarios can certainly be thought of as linear in progressing from scenario 1 to 2, then 4, avoiding scenario 3 if possible. But we can also imagine, for example, a switch from scenario 1 to 3 or even a revolutionary transition from 1 to 4 in a short time. In a context of uncertainty, we cannot predetermine the evolutions and possible transformations by continuity, rupture, or reversibility.

Of course, behind what is thought or imagined, there are the thinking subjects: the actors in research and teaching who are more or less in phase with the scenarios mentioned, as they would be with others as yet unformulated. The views of these actors in regard to the disciplinary status quo, and to more or less disruptive change, are as numerous and diverse as the disciplines that constitute academic structures and cultures. One could say that the realization of scenario 1 would involve actors (teachers, researchers, academic leaders, etc.) who are conservators who favor maintaining the predominance of disciplinary organization. They might tolerate inter- and transdisciplinary approaches, as long as they do not affect the disciplinary organization. The implementation of scenario 2 would require reformers or transformative critics who are willing to engage in the gradual modification/adaptation of the disciplinary organization through the integration of new approaches found among and beyond disciplinary boundaries. In the case of incommunicability between disciplinarians and reformers, the characteristic negotiated approach of scenario 2 can potentially slip into scenario 3, a tribal academic war situation that is uncomfortable and uncertain in its outcome. It is here that the figure of the warrior (whether disciplinary or

postdisciplinary) would be activated, preferring paralyzing disagreement to constructive dialogue. By trying to avoid the status quo of scenario 1 and the unproductivity of scenario 3 while going further and accomplishing more than is possible in scenario 2, scenario 4 is based on the figure of the revolutionary who aims for radical change, namely, re-founding the disciplinary organization of knowledge and, in the process, imagining and creating a postdisciplinary university operating under a new epistemological and institutional regime of knowledge production. As suggested in Klein's reflections on the conditions conducive to interdisciplinarity (Klein, 2010b), it would be a question of creating a postdisciplinary campus culture that modulates or removes the barriers and disincentives to interdisciplinary work at many different levels and in many different forms: the organizational structure in disciplinary silos and rigid university policies regarding procedures and resources and infrastructures and regarding recognition, reward, and incentives. The challenge is very ambitious – perhaps utopian – insofar as new strategic visions and facilitating mechanisms for the development of a very different campus culture would be necessary for actors to carve a postdisciplinary path through unknown territory.

It goes without saying that any imagining of actors with these different profiles into reality should be done with nuance and flexibility. Any actor, any researcher, teacher, etc., may embody one or other of these profiles more or less sustainably, being a conservator, a reformer, a warrior, or a revolutionary at intervals or all throughout his academic career, or may evolve and transform himself by passing from one profile to another. A conservator might evolve towards a more reforming logic through his openness to inter- and transdisciplinary dialogue, or on the contrary become radicalized in his fierce opposition to this kind of destabilizing approach; an academic warrior might return to a more moderate position, or become open to transformative practices; a reformer might push the logic of rupture further and become revolutionary, etc. In short, many (poly-)identitary configurations are possible, given academic trajectories that may involve evolutions, transfers, or reversals. The reformer profile (scenario 2), even that of the revolutionary (scenario 4), presents characteristics in phase with those identified as typical for interdisciplinarians. Both echo the main features and skills of inter- and transdisciplinary individuals (Klein, 1990; Augsburg, 2005, 2014; Repko, 2008): reliability, flexibility, patience, resilience, risk-taking, altruism, preference for diversity, tolerance of ambiguity, openness to complexity, ability to think dialectically, etc. People with profiles reflecting such features and skills may well struggle to express themselves in universities still dominated by those with disciplinary profiles pursuing academic careers that glorify

the sacrosanct disciplinary principle. However, those with these inter- and transdisciplinary profiles are perhaps the seeds of the postdisciplinarity of tomorrow, willing to challenge those whose belief in disciplinarity hinders the full expression of their transgressive impulses. Such seeds may grow.

4. Conclusion

Among the various drivers that might steer commitment towards the path of inter- and transdisciplinarity, and even more postdisciplinarity, the reasoned consideration of the complexity of research objects and real-world situations justifies dialogical thought that exposes the limits of disciplinary insights, even radically questioning their value, so as to advance more innovative approaches to problem solving. The concept of postdisciplinarity can be located in relation to the canonical taxonomy of interdisciplinary studies that defines the concepts of multi-, inter - and transdisciplinarity. This article has done that. And the attendant conceptual and epistemological exploration has made it possible to sketch out current, probable, and possible scenarios in the medium or long-term future of the academy by putting into dialectical tension the tendency towards disciplinarization and that which turns towards postdisciplinarity. Thus envisioning possible futures is not a matter of acting as an academic Nostradamus, soothsayer, or utopian. It is more about recognizing the distance that separates interdisciplinarity and transdisciplinarity, and even more postdisciplinarity, from disciplinarity – and then recognizing how one might move along that path.

To do so, though, would-be agents of change must achieve legitimization of their transgressive, non-conformist, and ultimately "undisciplined" attitudes. On this point, universities and, more broadly, all the actors in the education system, still have a ways to go: to become fully aware of the changes under way, and of the expectations and aspirations of interdisciplinarians who would be change agents, making them a place inside or outside the dominant system, as self-critique might prompt them to do, and accepting (and even promoting) the cognitive and institutional mutations of the disciplinary status quo that are likely to come.

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