

1. Introduction and Phrasing of the Question

“The university of the future will be interdisciplinary,” the headline in *The Guardian* said on January 24, 2018. It concerned an opinion article by Zahir Irani, Dean of Management and Law at the Bradford University School of Management in the United Kingdom. Irani argues that traditional departmental structures impede research and education in their evolution in a changing world. These structures lead to rivalry and a struggle for resources and funding, rather than encouraging collaboration. According to him, it is time for something new. Irani (2018) sees an urgency in terms of content:

Departments make it harder for academics to push boundaries as they struggle to find new intellectual homes for ideas that don't fit neatly into disciplinary boxes. Students lose out too: poorly managed course development across disciplines can lead to a joint degree that is two mealy halves joined together rather than a seamless matrix of ideas and challenges.

It is precisely the design of interdisciplinary courses, in which one discipline learns from another and disciplines are integrated, that would lead to context-specific programs that better serve organizations in the outside world and better prepare students for the labor market. It could also reduce the artificial and wretched separation within the university between education and research. Moreover, according to Irani, academic members of staff at universities also have an interest of their own because research councils, such as the *NWO* (Nederlandse Organisatie voor Wetenschappelijk Onderzoek – The Netherlands Organisation for Scientific Research), the *FWO* (Fonds Wetenschappelijk Onderzoek – the Research Foundation – Flanders) in our region, and other research funds are increasingly willing to invest in broader, innovative, and socially relevant research. Think of the Dutch National Research

Agenda and the new Horizon Europe program, which will be discussed later in this essay, in which interdisciplinarity and co-creation are central.



"I'M ON THE VERGE OF A MAJOR BREAKTHROUGH, BUT I'M ALSO AT THAT POINT WHERE CHEMISTRY LEAVES OFF AND PHYSICS BEGINS, SO I'LL HAVE TO DROP THE WHOLE THING."

Source: Sidney Harris via CartoonStock

The ultimate argument here, which is further discussed in this essay, is that interdisciplinary collaboration is a prerequisite for science to contribute to major problems – *wicked problems* – and thus generate impact of knowledge (Tromp, 2018). Menken & Kestra (2016, p. 34) put it briefly and to the point: complexity is “the main driving force behind interdisciplinarity.” However, as Brewer (1999) puts it succinctly, “The world has problems, but universities have departments” (quoted by Hoffmann - Riem et al., 2008, p. 4).

Interdisciplinarity is also pursued in practice elsewhere

The discussion about interdisciplinarity does not only play a role within the university or higher education but also, largely, in the practice of other sectors: wherever knowledge is applied. Think of healthcare. In hospitals, for example, a large number of specialists work who have a lot of knowledge of a part of the human body. It remains

difficult to organize it in such a way that a patient with his or her problem is diagnosed and treated in an integrated and interdisciplinary way (and not only partially or sequentially) while he or she is indivisible and there are all kinds of connections between different functions and somatic and psychosomatic abnormalities.

In the mid-1990s and at the beginning of the 21st century, the debate on the transcendence of disciplinary research was fundamentally fueled by authors such as Michael Gibbons, Camille Limoges, Helga Nowotny, Simon Schartzman, Peter Scott, and Martin Trow, who saw or advocated a shift from so-called Mode 1 science to Mode 2 knowledge production (Gibbons et al., 1994; Nowotny, Scott & Gibbons, 2001; Barry & Born, 2013b, p. 1). Mode 1 is solely about striving for scientific knowledge, in the form of fundamental research while Mode 2 is about the collaboration or integration of scientific disciplines that, in their application, are focused on real life problems (see diagram 1 below). This knowledge is, therefore, not only disseminated academically (journals, conferences, scientific societies), but also in society.

Diagram 1

Mode 1	Mode 2
Academic context	Context of application
Disciplinary	Transdisciplinary
Homogeneity	Heterogeneity
Autonomy	Reflexivity/social accountability
Traditional quality control (peer review)	Novel quality control

Obtained from Hessels and Van Lente (2008).

The Royal Netherlands Academy of Arts and Sciences (KNAW) has been actively engaged in the theme of interdisciplinarity since 2006. In “Bruggen Bouwen” (Building Bridges) De Boer et al., 2006), the experiences and visions of scientists are identified and various recommendations are made. As a sort of sequel, the KNAW’s The Young Academy presented its advisory report “Pushing Back the Boundaries: Opportunities and Obstacles to Interdisciplinary Research” (Grensverleggend. Kansen en belemmeringen voor interdisciplinair onderzoek). The Young Academy sees every reason to break down barriers in scientific research: interdisciplinary research contributes to scientific innovation and results in the broadening and deepening of individual disciplines. It creates knowledge that transcends disciplines and seems indispensable for solving complex social issues. In the same year, the Flemish counterpart of the Young Academy - the Young Academy of the Royal Flemish Academy of Belgium for Science and Arts (KVAB) - published the “Standpunt Interdisciplinair onderzoek in Vlaanderen” (Viewpoint Interdisciplinary research in Flanders). In this Viewpoint, a number of challenges are exposed that (young) interdisciplinary researchers in particular face, and suggestions are formulated on how university boards and councils and academic

stakeholders can better support interdisciplinary research (KVAB Young Academy, 2015).

In 2016, the League of European Research Universities (LERU) published the report “Interdisciplinarity and the 21st century research-intensive university” in which interdisciplinary collaboration is considered the “powerful driver of knowledge creation, scientific progress and innovation.” This report also contains a multitude of observations and recommendations regarding the organization and facilitation of interdisciplinarity.

Recently, the KNAW’s The Young Academy (2018) published a similar exploration and inventory with regard to interdisciplinarity in academic education. These opinions and the advantages, disadvantages, and obstacles identified in relation to interdisciplinarity are discussed in more detail below.

However, the above insights and positions with regard to exploring and promoting interdisciplinarity are not undisputed. This is made clear in various publications, including the book by Jerry A. Jacobs with the self-explanatory title *In Defense of Disciplines* (Jacobs, 2013, see also Graff, 2015). Jacobs resists the image of “disciplinary silos” that need to be demolished, and he observes that the exchange of ideas and research results among disciplines generally runs smoothly. He doubts whether a reorganization of the university structure will lead to added value and argues that the promotion of integrated courses at the university is as difficult as organizing interdisciplinary research. He also states that disciplinary specialization is a reaction, perhaps not perfect, to the dire need to distinguish intellectual domains. With more than 28,000 peer-reviewed journals and hundreds of scientific societies, no new organizational arrangement for academia could avoid a certain degree of specialization.

Another frequently heard counterargument is that the movement towards interdisciplinarity would come at a cost for the scientific strength and sharpness of disciplines. The doom image is that scientists will become jacks of all trades, neglecting their own discipline, developed with great pain and effort, which will ultimately lead to “undisciplined” science practice or even undisciplined chaos (Darbellay, 2014), which is at odds with scientific standards. It is obviously important to take these criticisms and reservations seriously (Szostak, 2017).

In this essay we want to continue on this issue, which is essential for science, university, and society. We do this by raising the following questions in this order:

1. What exactly is interdisciplinarity and how does it distinguish itself from other forms of collaboration that transcend disciplines?

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2. How, in short, has the practice of science proceeded with regard to the organization in disciplines; is interdisciplinary scientific practice increasing; and where do we stand now?
3. Is there a case for further strengthening and stimulating interdisciplinarity in research and education at the university? Why or why not?
4. If so, how can interdisciplinarity best be organized in academia, specifically in Tilburg? We also refer to the developments that are taking place within our partner university the KU Leuven.²

² One of the authors of this essay, Peggy Valcke, works at the KU Leuven and was a guest lecturer for many years at Tilburg University, where she and Ton Wilthagen coordinated the course Interdisciplinary Study of Law within the joint Research Master’s programs in law in Tilburg and Leuven. This essay is partly based on these personal experiences.

2. What Is Interdisciplinarity?

2.1 The I-Word

For a further debate on the desirability of promoting interdisciplinarity in research and education, it is important to have a working definition of the concept. Formulating such a definition is less obvious than it may seem. The Young Academy refers in its aforementioned advisory report from 2015 to the i-word and to a foggy situation (see also Klein, 1990, p. 12). A nice anecdote from The Young Academy's side (2015, p. 10) is that its potential new members are also asked during the selection procedure how interdisciplinary the candidate's research is:

——— Candidates do their utmost best to ensure that they have a strong aversion to disciplinary boxes and compartments and spread the interdisciplinary idea in both research and education. Nobody is raising his or her eyebrows to ask the selection committee “what exactly do you mean by interdisciplinarity?” Yet that would not be a crazy question to ask in return. The term nowadays functions as a kind of magic word in the academic landscape, without it being clear exactly what it means and to which concrete research practices it refers.

Barry and Born (2013a, p. i) also state in the foreword to their edited collection *Interdisciplinarity: Reconfigurations of the social and natural sciences* that the idea that research should become more interdisciplinary is a commonplace, but that the term is still not very illuminating:

——— The idea that research should become more interdisciplinary has become a commonplace. According to influential commentators, the unprecedented complexity of problems such as climate change or the social implications of biomedicine demand interdisciplinary efforts integrating both the social and

natural sciences. . . yet the term tends to obscure as much as illuminate the diverse practices gathered under its rubric.

With regard to a first definition of interdisciplinarity, The Young Academy refers to the definition of the *OECD*, the Organisation for Economic Cooperation and Development (Apostle, 1972), which can be found in much literature, such as in the report by de Boer et al. (2006, p. 12). This definition reads as follows:

Interdisciplinarity is a noun describing the interaction of two or more different disciplines. This interaction may range from simple communication of ideas to the mutual integration of organizing concepts, methodology, procedures, epistemology, terminology, data and terms organized into a common effort on a common problem with continuous intercommunication among the participants from the different disciplines.

As Lattuca (2003) rightly points out, this definition implies that interdisciplinarity has a continuum, ranging from informal exchange to the complete integration of concepts, methodology, etcetera. This is a more general view: interdisciplinarity as a continuum of intercommunication between disciplines. For example, the KVAB's Young Academy (2015, p. 13) describes interdisciplinarity as "intense collaboration across the boundaries of existing disciplines, both within and outside the academic world" (with reference to Repko, Szostak & Buchberger, 2014, p. 368). It notes in this respect that, depending on the intensity of the collaboration and the result achieved, a number of gradations can be distinguished (such as multi-, inter-, and transdisciplinarity; see more about this below).

The integrative aspect of interdisciplinarity is essential, as is its innovative character (Davies, Devlin & Tight 2010, p. 12). The *OECD* (2010) gives the example of nanoscience as an interdisciplinary domain, integrating physics and chemistry. Conversely, it contrasts research into the environment, for which a multidisciplinary approach predominates because the various disciplines operate strongly independently of each other. Another example is criminology, which can be regarded as an interdisciplinary behavioral science to which sociologists, psychologists, anthropologists, and lawyers contribute (Jefferey, 2006, Bosma & Buisman, 2018). Disciplinarity can be "forgotten" interdisciplinarity (Schaffer, 2013, p. 58). Also consider astronomy.

Barry and Born (2013b pp. 3-4) rightly point out the need not to portray interdisciplinarity as a historical novelty, in the sense that, in the past, generating knowledge was exclusively done via separate disciplines. Science has always developed in various institutions and not only in laboratories and closed domains. Moreover, the development of disciplines has regularly led to an interdisciplinary phase and to the emergence of practices and methods that would now be seen as interdisciplinary.

2.2 Other Forms of Transcendence of Disciplinarity

What matters is to compare the concept of interdisciplinarity with and distinguishing it from other forms of cross-disciplinarity. In particular, the difference with multidisciplinary needs to be clarified because, as The Young Academy and many other commentators have observed, interdisciplinarity, on closer inspection, is often about multidisciplinary. It starts, of course, with the term "discipline," which we will discuss in the next section. For now, a discipline can easily be described in the Stichweh formulation (2001) as the primary unit of internal differentiation of science for both research and education. Monodisciplinarity then seems obvious as the carrying out of research within the confines of one such "primary unit" or discipline. However, another dimension can be added here with the term intradisciplinarity. If we take the discipline of law, for example, the interaction between labor law and tax law in research into the self-employed worker is a form of intradisciplinarity.

Multidisciplinarity (sometimes called *pluridisciplinarity*) is generally described as a joint or separately organized form of researching of an issue looked at from the point of view of several disciplines, whereby the disciplines continue to work with their own standard disciplinary frameworks (Barry & Born, 2013a, p. 8; Klein, 1990 p. 56).

Cross-disciplinarity is also referred to in a specific sense as viewing a particular discipline from the perspective of another discipline, whereby aspects of one discipline can be explained by another discipline. Think of the politics of literature or the physics of music (Davies & Devlin, 2010, p. 11).

Transdisciplinary research is described as a new field of research that is developing in the knowledge society and links science and policy to address problems such as environmental degradation, new technology, health, and social change. Through a transdisciplinary approach, researchers from different disciplines work together as well as with external stakeholders to tackle problems in the "real world" (Hadorn et al., 2008; Cronin, 2008).

Finally, the term *postdisciplinarity* has also been coined, whereby the starting point is that disciplinary structures are completely abandoned in favor of intellectual freedom. In the words of Buckler (2004, p. 2):

The term "postdisciplinarity" evokes an intellectual universe in which we inhabit the ruins of outmoded disciplinary structures, mediating between our nostalgia for this lost unity and our excitement at the intellectual freedom its demise can offer us. Is the era of postdisciplinarity upon us now?

Post-disciplinarity could thus be understood as the definitive reunion or reintegration of individual disciplines.

A musical *art-science* project about interdisciplinarity in Tilburg

A specific form of interdisciplinarity consists of initiatives developed under the heading of art-science (Born & Barry, 2013a, pp. 247–272). The relationship and collaboration between science on the one hand and art and literature on the other is growing. It works both ways. Science and scientific ideas have always inspired the arts. But science is increasingly offering new media and methods for artistic exploration, such as the use of artificial intelligence and robotics in composing music or making paintings.

Science, in turn, can develop better means of communication through collaboration with art and reach a larger or new audience. It is even possible that better science could be achieved by working with art and artists, because artists ask different questions than scientific peers do (Kieniewicz, 2012, 2013).

In the light of writing this essay and addressing the theme of interdisciplinarity, we have set up an art-science project initiated by Tilburg University. A group of musicians consisting of Jan Wirken, percussion and coordination; Philipp Rüttgers (Germany), piano and composition; Mete Erker, tenor saxophone; Hein Offermans, double bass; and Romain Bly (France), horn, has accepted the assignment to make a composition and to perform during the Dies celebration on November 15, 2018 on the theme of interdisciplinarity from a musical-artistic interpretation. During the musical process and the process of writing this essay, there was regular contact between one of the authors of this essay and the group of musicians, in which a spoken word text, definitions, analyses, and dilemmas of interdisciplinarity were exchanged and discussed. Scientists were also present at the rehearsals and recordings.

The *spoken word* text, written by Ton Wilthagen, which is included in the composition, reads as follows:

A Time for Interdisciplinarity

We've arrived at the intersection
Ready for joint action
To go beyond boundaries
With musical passkeys
Discovering the methodology
Now we can hear and see
The full potential of the interplay
Of disciplines across a wide array
Here's the allusion
To the added value of fusion
New players, new jam sessions

Or chord progressions
Contextualizing harmony and innovation
A future ahead of co-creation.

The Young Academy (2015) is not satisfied with the above-mentioned *OECD* definition of interdisciplinarity – because the disciplines are the beginning and the end – and, in its advisory report, it tries to define the concept of interdisciplinarity, based on a Socratic discussion with scientists from various disciplines.

The conclusions of this brainstorming session are (The Young Academy, 2015 p. 12):

1. On closer inspection, often interdisciplinarity is multidisciplinary;
2. Interdisciplinarity changes the scientific identity of the researcher;
3. Interdisciplinarity can come about in different ways;
4. Interdisciplinarity has positive and negative effects.

Ultimately, The Young Academy (2015, p. 14) defines interdisciplinarity as “a transformation of scientific identity created by symbiosis of disciplinary questions, methodologies, and outcome measures.” The focus on scientific identity, alongside integrality, is an interesting starting point, which we will return to in this essay. In relation to education, The Young Academy (2018, p. 6) uses the following definition of interdisciplinarity, which is reasonably in line with the oft-cited *OECD* definition:

Education given by teams or individuals in which information, data, techniques, methods, perspectives, concepts, and theories from two or more disciplines or fields of education are applied and integrated, with the aim of addressing practical or theoretical problems of which the solution is outside the scope of one discipline.