

## Crossing Scientific Boundaries by Way of Disciplines

Several of the articles in this book address topics at the interface of disciplines. The focus of this introductory article is thus on the characteristics of disciplines and their ability to interact with each other to achieve inter-disciplinarity in complex matters.

### What is a scientific discipline?

The Latin term *disciplina* dates back to antiquity and refers to the instruction of disciples. Initially, it referred only to teaching and learning in the domain of the liberal arts, whereas research based on experiments or other form of empirical exploration was not added until the period from 1750 to 1850. The term ‘discipline’ currently includes both the production of new knowledge through research, and its transmission in an educational and organizational context.

At present, a discipline has a distinct subject matter, a research agenda, a curriculum, an associated theoretical framework and a common approach to study using appropriate techniques for understanding and discovering new knowledge. This means that disciplines are relatively delimited contingent of researchers who work within the academic and intellectual bounds considered theoretically legitimate among themselves. Biologists are supposed to concentrate on biology, psychologists on the mind, theologians on God, political scientists on politics, etc. In extreme historical cases, topics and issues were claimed the ‘property’ of designated disciplines, not to be shared or touched by others. Change is long overdue.

There is nothing absolute or sacred about disciplinary boundaries. They have not been established by intellectual consensus among representatives of adjacent disciplines, and there is simply no single criterion that dictates the setting of such boundaries. Thus, the delimitations are to some extent arbitrary, elusive, constantly disputed and artificial. Disciplines are not homogeneous units, and the stability and orderliness associated with mono-disciplinary research are often overstated and idealized.

The structure of disciplines is in a permanent state of flux: new disciplines emerge, established disciplines may shrink and fade away, or they may grow and recombine with others or disintegrate into several independent specialties. Thus the border areas, i.e. the peripheries, of disciplines act more like *transition zones* for the overlapping of disciplines than as distinct boundary lines (Matthews and Herbert, 04: 383). In the sociology of science, disciplines are defined as conglomerates of several subfields with multiple kinds of links to other disciplines and their subfields. From

#### Scientific Director and Editor Willy Østreng

Centre for Advanced Study  
at the Norwegian Academy  
of Science and Letters

E-mail: [willy.ostreng@cas.uio.no](mailto:willy.ostreng@cas.uio.no)



this point of view, a discipline is a ‘cluster of specialties’ – a multidimensional network in which it is difficult to identify a pure core that is independent from other disciplines (Bruun *et al.*, 05:27). Thus, the disciplines are to a large extent connected horizontally to each other through their respective specialties. This is to say that disciplinary specialties, which provide depth to research, are the backbone of interdisciplinarity, which provides breadth to research. The very concept of interdisciplinarity presupposes the existence of disciplines, which are the bureaucratic unit around which education, research and teaching are organized and implemented in most western universities. Thus, a discipline is best defined by its actual use and integrative ability as an *organizational unit for teaching and research, containing a network of professional links to other disciplines through its respective specialties*. In this way, disciplines constitute lasting entities of knowledge integration and organization.

### **Crossing boundaries**

Disciplinary boundaries can be transcended in two partly interconnected ways: by *boundary-breaking* and *boundary-bridging*.

Boundaries are broken when practitioners of one discipline turn to a different discipline for a new way of construing their own discipline or seek to bring part of the territory of another discipline under their own wings. Such boundary-breaking practices, long declared to represent subversive imperialism, have now become the accepted mode of behaviour for disciplinary researchers. We witness ‘trespassing’ on the turfs of others when psychologists extend their field from the human psyche to include humanistic disciplines such as art, religion and morals, or when political scientists study the political implications of novel technology, culture, religion, etc. Here, the same topics are addressed by many disciplines, and similar methodologies are applied across starkly contrasting fields. We witness what is known as *extended mono-disciplinarity* in which the role of boundaries is played down.

Boundary-bridging takes place when representatives of one discipline draw upon the work of related disciplines to solve problems as these problems are defined within their own discipline. These crossovers happen in the interface where two or more disciplines meet. These zones are the venue of fields, the fuzzy area where parts of disciplines, mingle, blend, change and multiply. These zones are where *hybridization* occurs.

Hybridization implies an overlapping of and contact between segments (specialties) of more than two disciplines, a recombination of knowledge and competence in new specialized fields and an activation of the multidimensional network of specialties. Specialization has given rise to a number of interactions when disciplinarians approach each other’s borders. It is the combination of specialties that produces integration between disciplines and reconfiguration of the disciplinary structure (Klein, 90:43). Many of the most creative specialties are hybrids. Re-combinations among them arise in the borrowing of concepts, theories and methods. In the history of science, a two-fold process can be observed: specialization within disciplines, accompanied by their fragmentation, is the first process, whereas the recombination of specialties across disciplinary borders is the second (Dogan, 01: 14851–14855). Hybridization, which has also been labelled the *genetic recombination of science*, takes place because specialization leaves gaps between disciplines and specialties and those gaps have to be

filled. This gap-filling process creates *hybrid disciplines* or *multidisciplinary disciplines*, i.e. a conglomerate of specialties sharing a common focus and/or object of interest or study. Political science is an example of a multidisciplinary discipline established in the interface between history, sociology, international law, geography, ethnography, social psychology and economics. This being the case, political analysis applies the methods and concepts of many disciplines interchangeably. At the same time, it is a distinct discipline in its own right through its defined and delimited focus on *politics* as a human phenomenon. The difference between *political science*, *political sociology*, *political economy*, *political-geography*, etc. is one of emphasis rather than kind, and the delimitations between them are indicative of the arbitrariness of disciplinary boundaries. Many of the hybrid disciplines also bridge the assumed gorge between natural and behavioural sciences by spinning off from their parent disciplines and finding new expressions in fresh settings or conglomerations. As a mix of cognitive psychology, artificial intelligence, linguistics, anthropology, genetics and philosophy, *cognitive science* is one of several examples of hybridization across the hard and soft sciences. Socio-biology is another.

### Summing up

Disciplines are conglomerates of specialties penetrating, bridging or breaking the soft and elusive borders erected between their parent disciplines. Disciplinary specialties have resulted in mergers of scientific fields – the first principle of interdisciplinarity. Thus, in the extended mono-disciplinary structure in which disciplines are subject to continued hybridization, specialties have become the dominant feature.

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