Complex Network Visualisation for the History of Interdisciplinarity

MAPPING RESEARCH FUNDING IN SWITZERLAND

CONTEXT

In Switzerland, the panorama of scientific research is deemed to be deeply affected by language barriers and strong local academic identities. Is this impression confirmed by data on research projects? What are the factors that best explain the structure of scientific collaborations over the last forty years? Do linguistic regions (Switzerland is divided into three principals) or local academic logics really have an impact onto the mapping of research collaborations and to what extend are they embedded in disciplinary, historical and generational logics?

We focus on the very large database of the Swiss National Science Foundation (SNSF), the principal research funding agency in Switzerland, which lists all the 62,000 projects funded between 1975 and 2015. While scientometric studies generally focus on measuring work - and financial - performance, we aim to raise awareness on pursuing a socio-historical analyse of Swiss academic circles by crossing the SNSF data with a prosopographic database of all Swiss university professors in the twentieth century provided by the Swiss Elite Observatory (OBELIS).

Beyond the interest for the history of science and universities, we explore the noteworthy technical challenge of a network analysis of nearly 88,000 researchers and more than a million of collaborations.

By combining those two databases, we measure the temporality and spatiality of academic collaborations, and we define a way to deal with the volume of information in order to provide not only a global vision but also to enable a fine processing of personal trajectories.

SOURCES

The SNSF database has been placed under an Open Data licence in spring 2016. Called "P3" for "Projects, People, Publications", it contains detailed information on all the projects funded since 1975 (around 500 per year in the beginning, almost 3,000 per year today, see histogram below), as well as the whole list of people involved in the projects. The database can sometimes be incomplete about the discipline and institutional affiliation of individuals, since it depends directly on the project submission interface where some fields may be left empty. Thus, this gap is partly offset by the junction with the Swiss professors database that provides systematic data. The projects themselves are classified according to a standard tree of scientific disciplines.

ANALYSIS

Here, we are interested in the 2006-2015 period, ten years during which 25,000 projects involving 45,000 people produce a 2-mode graph of more than 63,000 edges. On the one hand, this short periodization allows us to confront our assumptions to our data before analysing the full corpus. On the other hand, it helps to test the effectiveness of our tools and the interoperability of the two databases to prepare a complete and longitudinal modelling.

To focus on projects and disciplines, the network is then projected into a 1-mode graph of projects only (two projects are connected if they share one or more common researcher). Thus, the graph displayed here contains over 15,000 projects that were funded between 2006 and 2015.. The remaining 10,000 are isolated projects that are not displayed to avoid overloading the graph, but we they are taken into account in the analysis of the relationships between disciplines below.

The graph is very sparse in some places, particularly in disciplines where researchers work alone or in small groups (law, economics, humanities). In the natural sciences or medicine, projects often involve larger laboratories and thus create denser clusters. In order to say more about the interdisciplinarity of these fields, it is obviously necessary to develop the categories and to calculate individual measures, but the disciplines in which the collaborations occur are already clearly visible.

Reduced to the disciplines (below), the macro-network is more readable and will allow comparison over time.

COLORS
Discipline of the project

- SNSF Division 1
  Humanities and Social Sciences
- SNSF Division 2
  Mathematics, Natural and Engineering Sciences
- SNSF Division 3
  Biology and Medicine

LABELS
Displayed as information to make the network understandable, the situation is obviously more complex

SIZE
Project amount (CHF)

- 5K
- 100K
- 500K
- 1M
- 2M
- 5M
- 15M (max)

DISCIPLINES

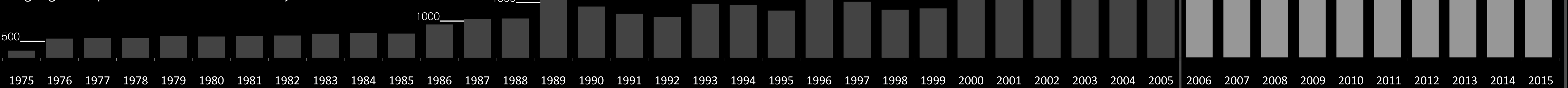SNSF Division 1
SNSF Division 2
SNSF Division 3

PERSPECTIVES

With the information contained in the list of projects, we see that it is possible to assign individuals a disciplinary category extracted from the projects involving them. As it happens that a researcher is participating to projects labelled in different disciplines, this approach will lead to a reflexion on the measurement of interdisciplinarity within a comparative study between a selection of "open" and "closed" disciplines. This is then compared with the discipline of their department, to show the difference between official affiliation and actual scientific activity.

We will also see that it is possible to develop a multi-level analysis to compare the graph clustering to the many Swiss institutional and disciplinary "geographies", in order to historicize their development and structuration. The graph of the disciplines (here right) shows for example that the three major "divisions" of the funding agency no longer fit perfectly to the reality of the 21st century.

Number of projects funded by SNSF annually
Highlighted: period chosen for this analysis

1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

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