

Multidisciplinarity on ESRC grants

This analysis summarises some of what our data tells us about the extent and nature of the disciplinary interaction which might be enabled by our research grants.

We are sharing it externally to invite comment, discussion and further analysis.

Key findings	2
The data	3
ESRC discipline classifications and terminology.....	3
Results	5
Connectivity.....	9
Disciplines as networks.....	10
Conclusions.....	14
Annex – The process of selecting classifications.....	15

If you have any questions or comments about this analysis please contact the head of ESRC's Insights team, alex.hulkes@esrc.ac.uk, or telephone 01793 413039

Key findings

- 70% of ESRC grants are in some sense multidisciplinary, and more than three quarters of ESRC funding has a multidisciplinary aspect.
- More than a quarter of ESRC grants extend into disciplines outside ESRC's remit
- On its own, the presence of multidisciplinary on a grant has no reliably measureable effect on the chance of that proposal being funded.
- Key areas of disciplinary interaction outside social science are health and medicine, ICT, and media studies.

The data

This analysis is based on all ESRC research grants authorised from April 2011 to September 2017. In this context 'research grant' means anything that is not a training grant or a fellowship grant, and it includes KE activities, infrastructure and anything else that would not normally be funded through the other grant types. The total number of grants it draws on is just over 2000.

Some grants have no discipline data (for example ESRC Impact Acceleration Accounts, although these will inevitably be multidisciplinary) and so are excluded, removing about 50 grants. There is also a very small number of grants for which ESRC acted as a kind of issuing agent on behalf of another council and so which are mostly or perhaps entirely out of our remit. These are included in the analysis.

ESRC discipline classifications and terminology

The disciplines used here to describe the subject focus of each project are the 19 core ESRC subject classifications applied to grant proposals by our applicants:

- Area Studies
- Demography
- Development studies
- Economics
- Education
- Environmental planning
- History [that is, social and economic history]
- Human Geography
- Law & legal studies
- Linguistics
- Management & business studies
- Political science and international studies
- Psychology
- Science and Technology Studies
- Social anthropology
- Social policy
- Social work
- Sociology
- Tools, technologies and methods

There is no limit to the number of subject classifications that can be added to a proposal, although one primary discipline must be selected. There is no obvious strong incentive to over- or under-classify a proposal by adding more subjects than are needed to describe the project's reach, or too few to achieve the same end.

As well as the subjects which describe the 19 ESRC disciplines, applicants are able to select subjects associated with other councils. It is not clear whether they do so consistently. If there is a bias in the selection processes it seems likely that it will work to under-represent other councils' classifications on grants, for two reasons. Firstly, applicants may believe that if they classify a proposal using too many non-ESRC subjects, that proposal might be considered out of remit (not true by the way). And secondly, applicants may simply not want to navigate through dozens of unfamiliar potential subjects to find the most appropriate combination for their proposal.

Overall we do not know what drives applicant behaviour when deciding which and how many subject classifications to add to a proposal (see annex for a discussion of what is probably not happening with the latter) but in general the classifications we see appear to reflect proposal content quite reliably.

Because each subject classification relates to a discipline, the presence of more than one discipline on a proposal can be understood literally only as indicating that the project described in the proposal could not, in the opinion of its principal investigator, satisfactorily be described with reference to just one discipline. Whether the project is multi-, inter-, cross-, trans-... disciplinary, each of which could be signified by the association of more than one discipline with a proposal, we cannot determine using just this data.

While it is inaccurate to say that this analysis describes the degree of multidisciplinary in the ESRC portfolio, it would be more inaccurate to say that it does something other than that¹. As the lesser of two evils, the terminology used from here on is strictly one of multidisciplinary, with the understanding being that other types may be signalled by the use of more than one discipline classification in association with a project.

¹ Alternatively this could be seen as an analysis of the absence of single discipline work. This is still more correct but is probably needlessly convoluted.

Results

The counts of grants having 1, 2, 3...8 unique disciplines assigned (no grant had more than eight) are in Figure 1:

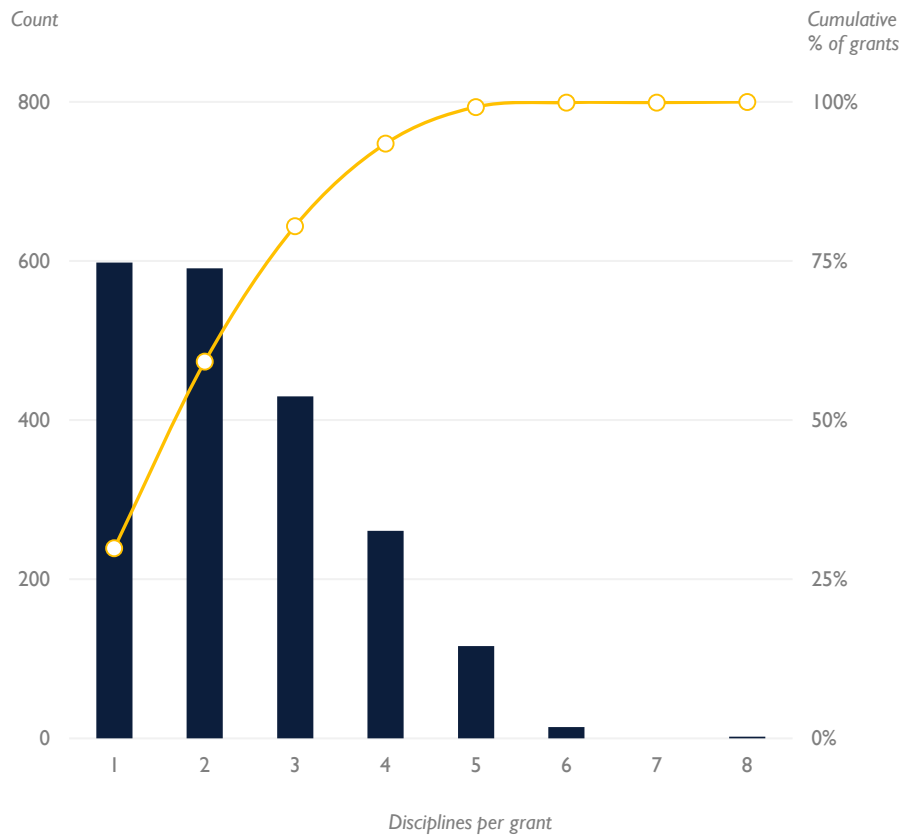


Figure 1: counts of grants (dark blue, left axis) and cumulative % of grants (yellow line, right axis) having 1 to 8 unique disciplines assigned for ESRC research grants authorised April 2011 to September 2017

The mean and median numbers of disciplines assigned per grant were 2.4 and 2 respectively.

A total of 63 subjects were used to classify the grants in the data set, meaning that 44 non-ESRC subjects/disciplines were used by applicants². This introduces the possibility of two kinds or degrees of multidisciplinary in the portfolio, which will be reported separately:

- grants which had more than one discipline assigned and for which all disciplines were core ESRC disciplines (ESRC multidisciplinary grants)
- grants which had more than one discipline assigned, some of which some were not core ESRC disciplines (cross-council multidisciplinary grants)

The numbers, values and proportions in each category are:

	By number		By value	
Single discipline, ESRC only	598	30%	£203,470,000	22%
ESRC multidisciplinary	872	43%	£395,500,000	43%
Cross-council multidisciplinary	535	27%	£320,680,000	35%

And the same data in chart form (Figure 2):

² One of these non-ESRC disciplines is problematic. ‘Demography and human geography’ is a subject which conceptually combines two ESRC core disciplines but which is not in the set of 19 core ESRC disciplines. It is assigned less frequently than used to be the case, but is still used occasionally – a total of 86 times in the dataset. It seems likely that all grants classified as ‘Demography and human geography’ could be classified using one or both of the core ESRC disciplines of ‘Demography’ and ‘Human geography’, with knock-on effects on the proportions of cross-council multidisciplinary and multidisciplinary overall. The net effect is small (2 or 3% changes might be seen) but large enough that figures given should be understood as approximate only.

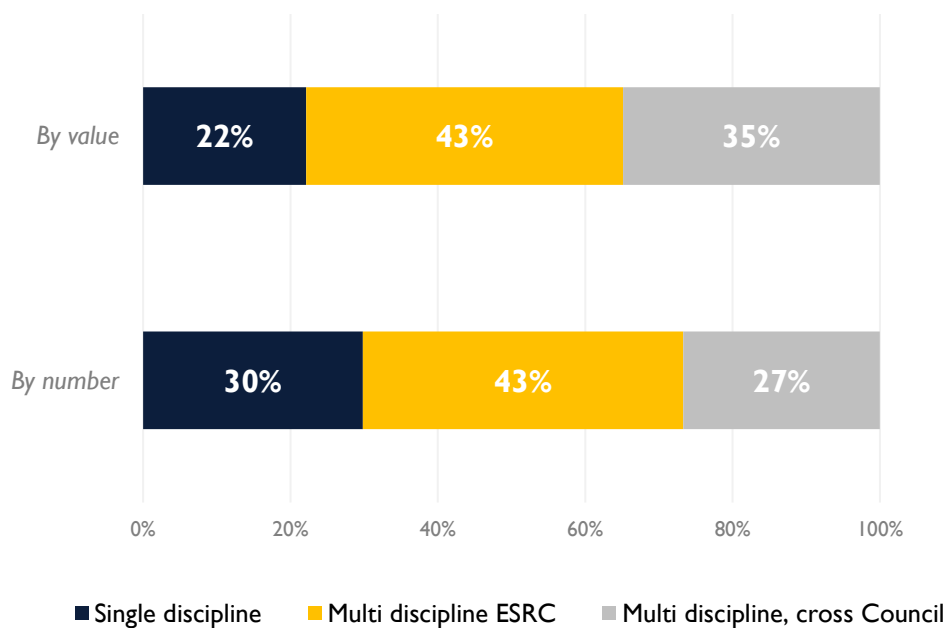


Figure 2: proportions of grants by value (top) and number (bottom) which were single discipline (dark blue), multi discipline within ESRC (yellow) and multidiscipline, cross-council (grey) for ESRC research grants authorised April 2011 to September 2017

70% of grants authorised by ESRC in the period covered by the data were multidisciplinary. 27% of grants stretched beyond ESRC’s remit while 43% featured combinations of two or more social science disciplines. Only 30% of grants did not feature a degree of multidisciplinary significant enough for it to be recorded.

As multidisciplinary projects of both kinds are in a significant majority it is not possible for there to have been large, systematic differences in success rates between multi- and single-discipline proposals³.

Around three quarters of ESRC research project funding awarded in the period was assigned to projects which were multidisciplinary. As 78% of the funding but only 70% of the

³ If we make around 1000 decisions a year and have an overall success rate of around 20%, even in the most extreme case (of a 100% success rate for single-discipline proposals), multidisciplinary proposals would have a success rate no more than 5% lower than the overall average. More realistically if there were a difference it would be very small (perhaps 1-2%), certainly too small to be reliably detectable with that sample size. And of course without further evidence and analysis it would be wrong to assume that a difference in success rates, were one to exist, was caused by the multidisciplinary nature of proposals. Other factors will determine the final allocation of resources at least as strongly.

grants were multidisciplinary, it is safe (and probably unsurprising) to conclude that multidisciplinary projects tend to be larger than their single-discipline counterparts.

This is true of the mean average (£340,000 vs £510,000 for single- and multidisciplinary grants) but the median averages are to all intents and purposes the same (£200,000 vs £190,000 respectively.) The greater mean average size of multidisciplinary projects reflects the presence of a few large grants, and the preponderance of multidisciplinary projects by value is at least partly associated with a tendency of larger projects to cover more disciplinary space.

The same general distribution of disciplines is found in responsive mode (Figure 3):

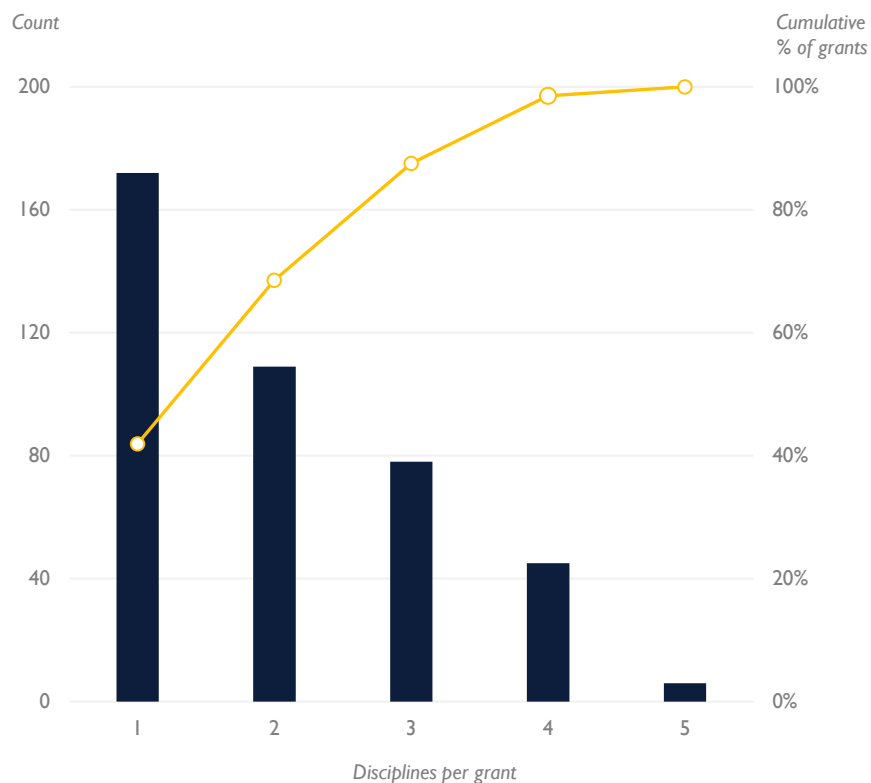


Figure 3: counts of 'Open Call' grants (dark blue, left axis) and cumulative % of grants (yellow line, right axis) having 1 to 8 unique disciplines assigned for ESRC research grants authorised April 2011 to September 2017

While a slightly greater proportion of grants is single discipline in responsive mode (42%) than is the case overall, again the majority of projects funded (58%) is multidisciplinary.

Connectivity

The presence of more than one discipline on a grant indicates a connection, of some kind, between disciplines enabled by ESRC funding. Different disciplines might be expected to have different degrees of interactivity with (as indicated by co-occurrence of) other disciplines.

The mean number of other disciplines found co-occurring on ESRC grants for each of the 19 core ESRC disciplines is shown in Figure 4:

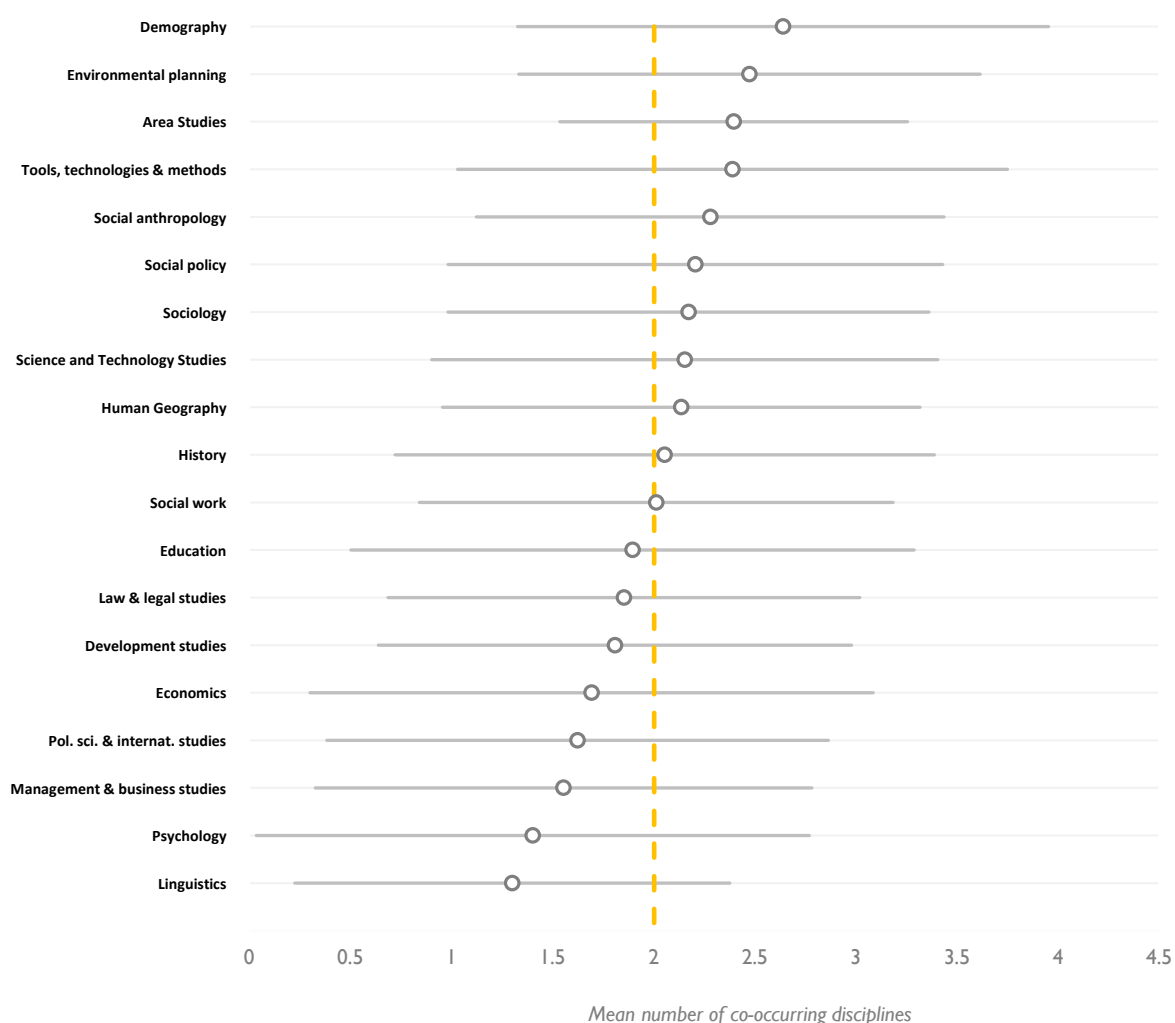


Figure 4: mean number of co-occurring disciplines on grants having each ESRC core discipline, for ESRC research grants authorised April 2011 to September 2017. Error bars indicate one standard deviation of the data for each discipline. Overall mean number of co-occurring disciplines (2.0) shown in yellow.

While some disciplines tend to be associated with higher numbers of companion disciplines than do others, there is a wide spread in the data for each and little meaningful difference between their averages⁴.

Disciplines as networks

Disciplinary data lend themselves well to network analysis: each instance of co-occurrence of disciplines on a grant creates an edge, the disciplines themselves being nodes.

There were just under 5000 instances of co-occurrence of disciplines across the 1400 or so grants which were classified with more than one discipline. The proportions of co-occurrence which indicated connectivity within and across ESRC and other councils' remits were:

	Count	% of total
ESRC - ESRC	3165	65%
ESRC - Other RC	1471	30%
Other RC - Other RC	237	5%

The majority of instances of connectivity between disciplines were within the social sciences, with around a third being more far-flung. Only a small proportion of grants have two or more non-ESRC disciplines, identifying multidisciplinary entirely outside the ESRC space. While multidisciplinary pervades the ESRC portfolio, for the most part disciplinary interactions reflect our remit.

The actual network which is implicit in the data is shown in Figure 5:

⁴ The error bars are set at one standard deviation, implying that around two thirds of that discipline's grants have a number of co-occurring disciplines in that range. This is only an approximation and clearly the actual number on each grant must be a whole number of disciplines: for example, Psychology's true range is probably 0 to 3, Area studies' is 1 to 3.

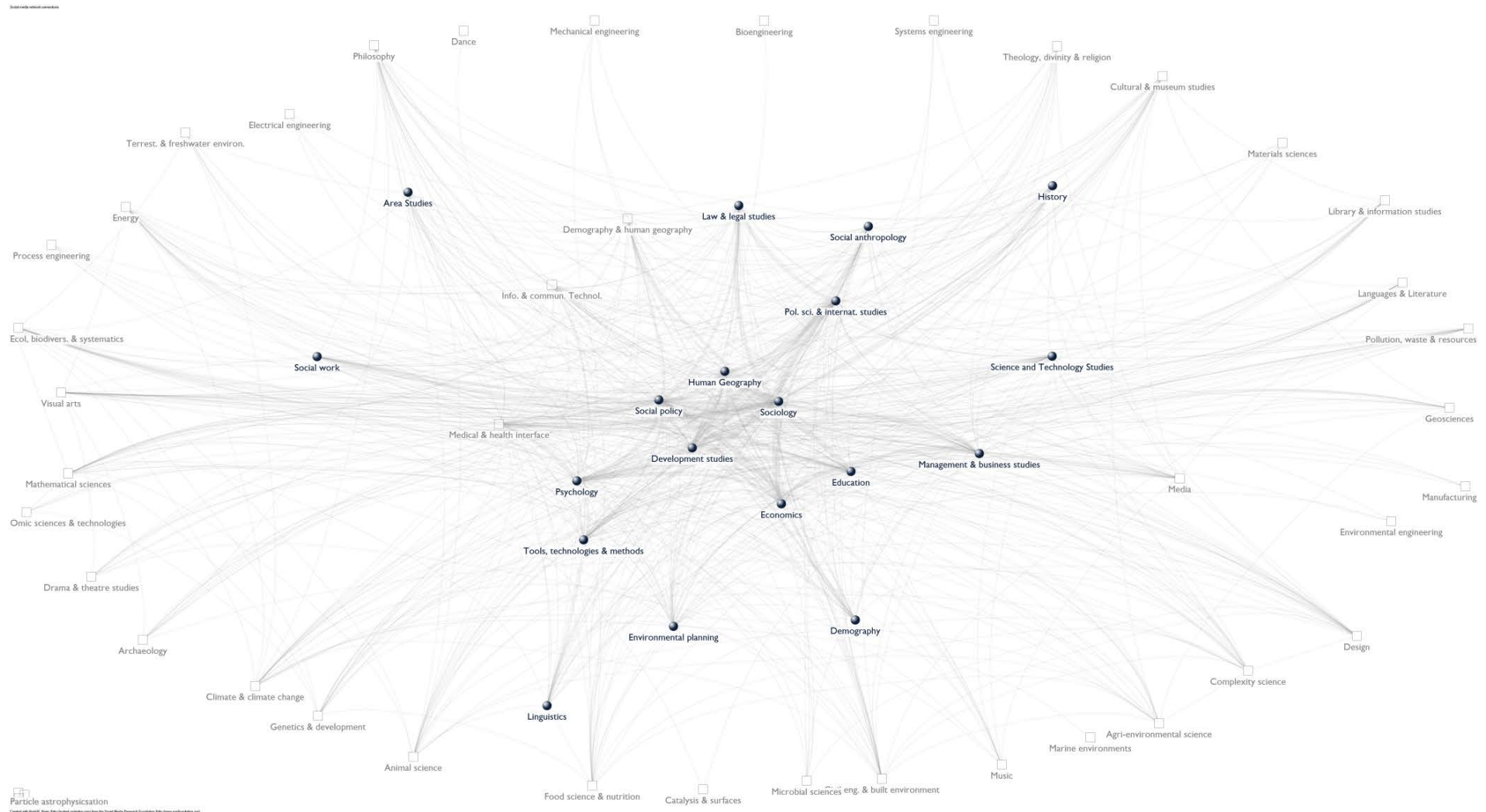


Figure 5: network diagram summarising connectivity between disciplines on ESRC research grants issued between April 2011 and September 2017. Core ESRC disciplines are in dark blue, other councils' disciplines in grey. Edge widths scaled to reflect observed co-occurrence frequency.

There is a huge number of potential metrics which can be used to summarise and understand networks such as this. Given the nature of the data the risk of over-analysis is greater than that of under-analysis so it is probably sensible to be reasonably restrained.

The network density is 0.34, meaning that 34% of the 1953 possible links between disciplines are actually found in the data. When looking at the 19 core ESRC disciplines, this figure rises to more than 0.95, with just eight of the 171 possible combinations of core ESRC disciplines not being found at least once. The missing eight are:

- Area studies - Demography
- Area studies – Education
- Area studies – Social work
- Demography – Linguistics
- Demography – Science and technology studies
- Environmental planning – Linguistics
- Environmental planning – Social work
- Linguistics – Social work

All these involve one or more of the smaller disciplines so there is unlikely to be anything particularly amiss when the size of each discipline is taken into consideration.

At the other end of the conceptual table, the ten most frequently found co-occurrences of disciplines are:

Discipline 1	Discipline 2	Frequency
Social policy	Sociology	180
Political science & intl studies	Sociology	106
Human Geography	Sociology	91
Economics	Sociology	88
Psychology	Sociology	84
Economics	Social policy	70
Education	Sociology	66
Development studies	Political science & intl studies	61
Education	Psychology	60
Development studies	Sociology	59

The highest ranked connection between an ESRC and a non-ESRC discipline is 11th, between ‘Medical & health interface’ and Sociology and which occurs 59 times. ‘Medical &

health interface' also comes in at number 28, paired with Social policy (40 instances), the next highest external connection (and first non-medical discipline) being the link between 'Media' and Sociology at number 46, with 27 instances. In general the top 100 links are dominated by ESRC core disciplines. About a third of all connections found occur only once.

This and the chart both tend to suggest a relatively active culture of interaction between social sciences and medicine, ICT and media studies, at least within ESRC grants and relative to other potential interactions.

The key metrics for the disciplines within our network are described below.

The **degree** of a node is the number of connections it has with other nodes. The ESRC discipline with the greatest degree is Psychology, with 47, that with the least being Social work, with 19.

The **betweenness centrality** of a node reflects the extent to which that node sits on paths between other nodes, and so the extent to which that node exerts 'control' over the network. The ESRC discipline with the highest betweenness centrality is Psychology (189), the lowest is Linguistics (3). Despite not being an ESRC discipline, 'Climate and climate change' has the fifth largest overall betweenness centrality (65).

The **closeness centrality** of a node reflects the distance of a node from all other nodes in the network. The ESRC discipline with the largest closeness centrality (and hence the one which is closest in this sense to all others) is Psychology (0.14) although there is very little variation in this metric across the ESRC disciplines.

The **PageRank** of a node reflects its importance in the network by incorporating information on the importance of the nodes to which it is connected. The discipline with the highest PageRank measure is Psychology (2.2) and the lowest is Social work (0.84).

The **clustering coefficient** gives an indication of the extent to which a node forms closed groups with other nodes, by linking to nodes which are themselves linked to each other (a sort of echo chamber measure.) The ESRC discipline with the highest clustering coefficient is Social work (0.94) and the lowest is Psychology (0.48).

In general larger disciplines tend to have more influence over, or to be more central to, the network. This will to some extent be because they receive more grants and so have a greater opportunity to form links with other disciplines.

Conclusions

The headline figure – that around 70% of the projects that ESRC funds support interactions of some kind between two or more disciplines – may surprise many. But it is clearly good news. As is the fact that a proposal to ESRC that crosses disciplines is no more or less likely to succeed than is a similar proposal that sticks within a single subject.

We know that 10% of the funding that we provide every year is consciously directed to grants in support of cross-council activity⁵. But we now also know that 35% of our funding features some degree of cross-council multidisciplinary. Much of what ESRC does to support working across council remits happens either quite naturally, or in response to the strategic priorities that we identify in partnership with the research and user communities. For ESRC at least, most cross-council funding is not the result of cross-council activity.

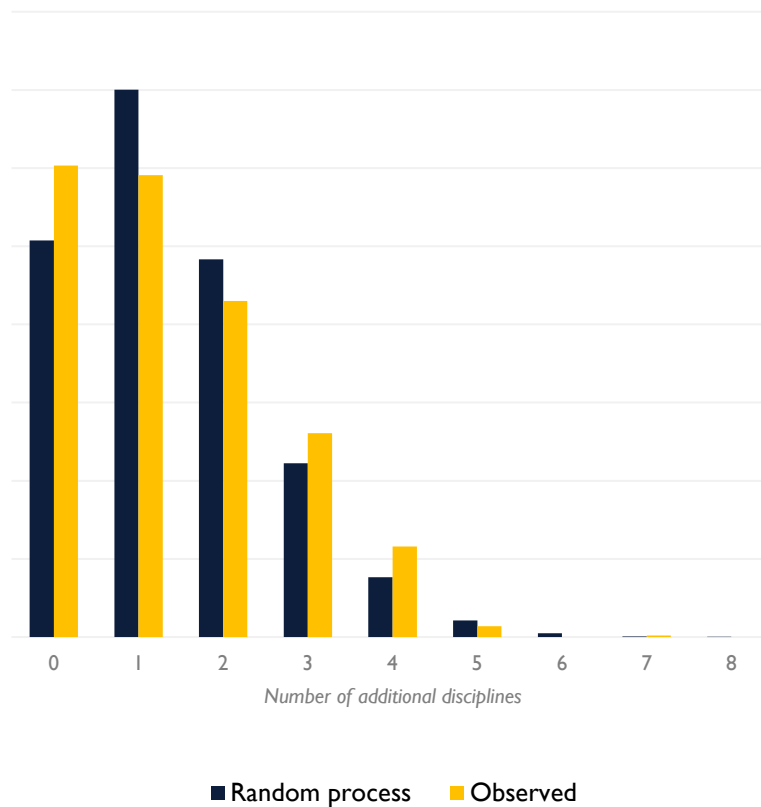
That's not to say that ESRC has multidisciplinary peer review cracked, or that it's easy to apply for or assess multidisciplinary proposals fairly, or that we don't need to do more. There are some aspects of multidisciplinary application behaviour which are likely to be more intractable. But this core part of our business seems to be on quite solid ground.

⁵ Internal analysis of ESRC spending in FY 2016-17.

Annex – The process of selecting classifications

The average number of disciplines which is used to classify a proposal is 2.4. So on average a discipline on a grant will find itself alongside 1.4 other disciplines.

If the number of disciplines assigned to a grant was random, in the sense that the person classifying the grant was selecting a random number of unique disciplines, then we'd expect to find the distribution of numbers of disciplines on grants shown below in dark blue.



Instead we see the distribution in yellow, suggesting that the processes that drive applicants' decisions about how many disciplines to select are non-random. There are more single discipline and mid-range multidiscipline projects (4 or 5 disciplines on a grant), but fewer instances of 2, 3 or 6+, than we might expect.