

Scientific vs. Interpretive: Social Sciences on a Scale of Academic Methodology

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ABSTRACT

The Social Sciences are commonly deemed similar to the Humanities, but they are also reminiscent of the Hard Sciences in their use of experimental and scientific methods. The Social Sciences are thus apparently similar to two discipline groups that seem to be polar opposites, but this has yet to be formally analyzed. To investigate the extent to which Social Science methodology can be placed on a scale between Hard Science (scientific) and Humanities (interpretive), we quantitatively¹ analyze a random sample of Social Science, Hard Science, and Humanities documents from the Elsevier corpus of academic literature. We find that the Social Science community is more interpretive than the Hard Sciences community, but still maintains a similar emphasis for scientific methods. On the other hand, the Humanities community is significantly more interpretive than the Social Science community, contradicting the idea that the Social Sciences are more similar to the Humanities than the Hard Sciences. Additionally, the Social Sciences are shown to have more methodological variation, indicating that they maintain unique characteristics from the Humanities and the Hard Sciences. Still, we conclude that the Social Sciences do fall towards the middle of a methodological scale between the Hard Sciences and the Humanities, and that this methodological scale can be used to ensure that scholars are educated according to their discipline's relative use of scientific and interpretive methods.

INTRODUCTION

In informal discussions about academic disciplines, the Social Sciences can often be lumped with the Humanities perhaps due to their people-oriented subject matter and study methodology. However, the Social Sciences are still similar to the Hard Sciences in their use of hard evidence and meticulously-designed experiments. This is interesting because, in many ways, the Hard Sciences and Humanities seem to be polar opposites, but Social Sciences still seem to share similarities to both of them. From this insight, one could plausibly conceptualize a scale of methodology with the Hard Sciences on one end and the Humanities on the other.

Academic disciplines can be somewhat naturally ordered on this scale on the basis that some are more *scientific* while others are more *interpretive*. Scientific disciplines, e.g. the Hard Sciences, rely on experiments and verifying hypotheses with evidence to make progress. Interpretive disciplines, e.g. the Humanities, put more emphasis on the author's interpretations and rhetorical analysis of qualitative evidence. Of course, at the micro level, the order of this methodology scale is somewhat subjective—for instance, the choice to put chemistry closer to humanities than physics would be quite arbitrary. However, it seems reasonable that Social Sciences in general are between the Hard Sciences and the Humanities in how scientific and interpretive they are. We may, then,² be interested in the similarities between the Social Sciences and Hard Sciences and, on the other hand, the similarities between the Social Sciences and Humanities.

¹ Expert vocabulary

² Metadiscourse (general)

This raises two questions. First, to what quantitative extent are the Social Science and Hard Science literatures similar in terms of their relative usage of scientific methods? Similarly, to what extent is Social Science literature similar to Humanities literature in their relative usage of interpretive methods?

Given the concept of the methodology scale, we should expect the Social Sciences to be somewhere in the middle, showing similarities with both the Hard Sciences and the Humanities that the two do not have in common with each other. This study investigates to what extent this is truly the case.

METHODS

Elsevier Corpus

We use a random sample of the Elsevier corpus of academic literature as our dataset. The Elsevier corpus in its entirety includes more than 40,000 documents—our random sample includes 20 documents from each of the 20 academic discipline categories in the corpus for a total of 400 documents. The sample is held natively in the DocuScope analysis tool.

DocuScope Corpus Analysis & Concordancer

DocuScope is a software tool for simple corpus analysis. It processes documents and their metadata to permit easy visualization and statistical analysis³ of a given corpus. In particular, documents can be automatically tagged, and the frequencies of these tags normalized by document or document group size can be compared. Statistical analysis of these frequencies is what we use to investigate our hypotheses.

Document Discipline Categories

Before investigating the Hard Sciences, Social Sciences, and Humanities literature, we must first define what they mean. To do this, we are restricted to DocuScope's list of 20 disciplines. Whenever possible, we include multiple disciplines under each discipline group to increase the quantity of documents in our analysis, thereby increasing statistical power.

Hard Sciences. We define Hard Science articles as any article under the BIOC (Biochemistry, Genetics, and Molecular Biology), IMMU (Immunology and Microbiology), CHEM (Chemistry), ENVI (Environmental Science), and PHYS (Physics and Astronomy) Elsevier discipline categories.

Social Sciences. We define Social Science articles as any article under the SOCI (Social Science), DECI (Decision Sciences), ECON (Economics, Econometrics, and Finance), and PSYC (Psychology) Elsevier discipline categories.

³ Reasoning

Humanities. We define Humanities articles as any article under the ARTS (Arts and Humanities) Elsevier discipline category. Unfortunately, there is only one fitting category for Humanities literature.

Language Tags

Signposting Academic Writing Moves. We use the Signposting Academic Writing Moves tag as a proxy for how scientific an article is. This tag encompasses descriptions of technical methodology, and typically occurs more often in scientific articles.

Citation Controversy. We use the Citation Controversy tag as a proxy for how interpretive a document's methods are. This tag indicates the reference of a source or a finding with a tone that questions its authority. We expect these to be more common in more interpretive arguments (i.e. Humanities papers), where there are many possible explanations and interpretations and thus more room for active debate in the literature.

The gt and ggplot2 R Libraries

After computed statistics are extracted from the DocuScope tool, we conduct all visualizations using R. We use the gt package (Iannone et al., 2025) to create tables and the ggplot2 package (Wickham, 2016) to create figures.

RESULTS

| Relationship | Tag | Log Likelihood | P Value |
|-----------------------------------|---------------------------------|----------------|---------|
| Social Sciences vs. Hard Sciences | SignpostingAcademicWritingMoves | 11.12 | 0.001 |
| | CitationControversy | -200.60 | 0.000 |
| Social Sciences vs. Humanities | SignpostingAcademicWritingMoves | -374.72 | 0.000 |
| | CitationControversy | 71.94 | 0.000 |

Table 1. Table log likelihoods and p-values (to the nearest thousandth) for the significance test of the difference between tag frequencies in Social Sciences versus Hard Sciences and Humanities. A negative log likelihood indicates the tag is more common in Social Sciences than the other discipline group in question.

To begin, it is helpful to more formally examine each tag in action to verify what they mean, allowing us to draw conclusions from the data. The Signposting Academic Writing Moves (hereafter SAWM) tag is associated with the descriptions of methodology that are typical in scientific literature. For example, the tag appears in one of the articles under the Social Science group as follows: “We then use econometric **modelling methods** to estimate disaggregated price elasticities of fuel demand, which we take to be indicative of the degree of car dependence and adaptive capacity of individual households” (Mattioli et al., 2018). The frequency of the SAWM tag thus approximately measures how scientific an article is.

On the other hand, the Citation Controversy tag is associated with references to a claim or finding with a tone that disputes its authority. For instance, from the same article: “As a result, what these studies actually map is car-related economic stress in the present time (i.e. areas where people are already spending too much on motoring), rather than what **they claim** to do, i.e. calculate...” (Mattioli et al., 2018). The Citation Controversy tag thus approximately measures how interpretive an article is; strongly interpretive articles will reference claims and evidence tentatively and then form their own viewpoint.

There is indeed a statistically-significant difference between the frequency of the SAWM and Citation Controversy tags between Social Sciences literature and Hard Sciences and Humanities literature. Table 1 shows⁴ that, rounded to the nearest thousandth, the p-values of three significance tests are zero, with the last one being 0.001. Thus all differences are significant at the 0.005 level.

As expected, Table 1 shows that the Citation Controversy tag is more common in Social Sciences than in Hard Sciences but less common in Social Sciences than Humanities. Meanwhile, the SAWM tag is more common in Social Sciences than Humanities but less common in Social Sciences than Hard Sciences. This illustrates that Social Sciences are somewhere between Hard Sciences and Humanities on the scale of empirical methods to rhetorical and interpretive methods. The Social Sciences are more scientific than the Humanities but less scientific than the Hard Sciences, while also being more interpretive than the Hard Sciences but less interpretive than the Humanities.

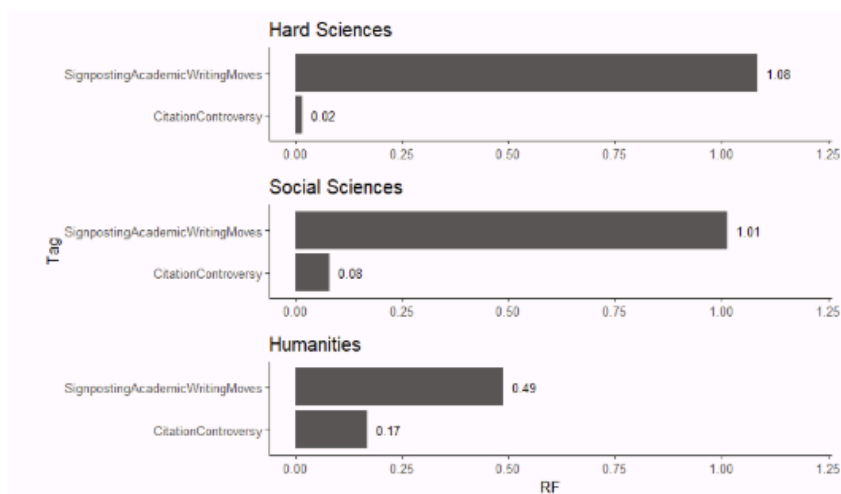


Figure 1. Regularized frequencies (per 100 tokens) of the Signposting Academic Writing Moves and Citation Controversy tags within each discipline group (Hard Sciences, Social Sciences, and Humanities).

We can also see that, although the SAWM tag is more common in Hard Sciences than Social Sciences, the regularized frequencies are relatively similar compared to the difference in Citation Controversy frequency between Social Sciences and Humanities. Figure 1 shows the regularized frequencies in question. The rate per 100 tokens for SAWM is 1.08 in Hard Sciences and 1.01 in Social Sciences—these are fairly comparable numbers. On the other hand, the rate for Citation Controversy is 0.08 in Social

Sciences, less than half the rate of 0.17 in Humanities. This shows that, on average, the Social Sciences literature does not forsake empirical methods in order to make more interpretive

⁴ Methods, Results, and Discussion

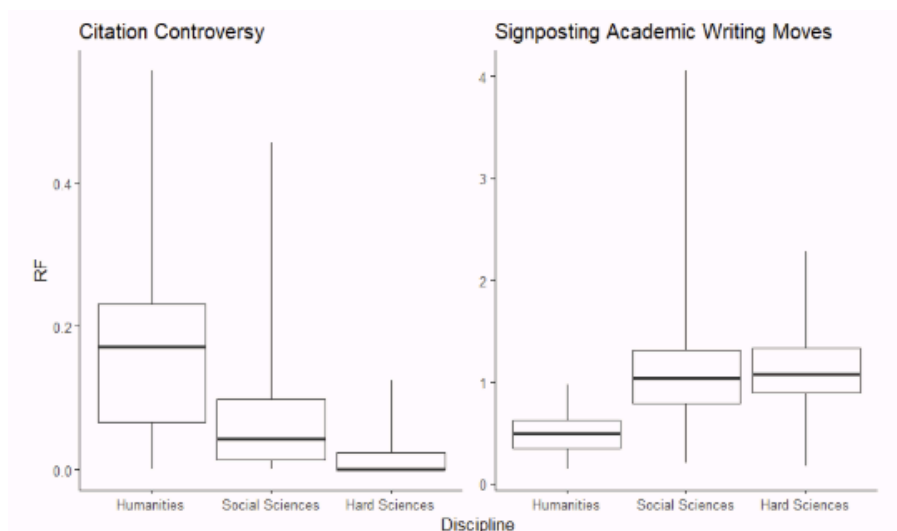


Figure 2. Boxplots of distributions of regularized frequencies (per 100 tokens) of the Signposting Academic Writing Moves and Citation Controversy tags within each discipline (Hard Sciences, Social Sciences, and Humanities).

arguments. Instead, it seems to keep emphasis on empirical methods high while also making more interpretive arguments than the Hard Sciences literature. This could have something to do with the more people-oriented subject matter of Social Sciences—when we get some quantitative result in the study of people and society, there are often multiple possible explanations or implications, leading to more active debate in the literature about results.

Despite the apparent belonging of Social Sciences on a scale between Hard Sciences and Humanities, it also appears to have some unique characteristics. Figure 2 displays the distribution of regularized frequencies per 100 tokens in each discipline group. In particular, we can see that there is much wider variation in the document-level appearance of the SAWM tag in Social Sciences than in Hard Sciences and Humanities. Although usage of SAWM in Social Sciences and Hard Sciences is similar on average as in Figure 1, the upper tail of the boxplot of SAWM frequency is much longer for Social Sciences in Figure 2. This illustrates that the distribution of SAWM tag frequency at the document level is wider for Social Sciences compared to Hard Sciences. Some articles in the Social Sciences spend a much larger portion of the paper elaborating on study methodology than others, which could have something to do with the detail required in explanation of some people-focused experiment design and methodology.

DISCUSSION

The results provide substantial evidence that the Social Sciences fall somewhere between the Hard Sciences and Humanities in terms of their study methodology. As seen in the regularized frequencies of the SAWM and Citation Controversy tags, the Hard Sciences community unsurprisingly favors evidence-based methodology, while the Humanities community makes more interpretive, subjective arguments. The Social Science community shows a similar

preference for scientific methodology seen in the Hard Sciences while also making more interpretive reasoning about quantitative results in the literature. This could be because Social Sciences study people and society, so by nature there must be more subjective interpretation of their quantitative results than those in the Hard Sciences.

It is worth noting that the Social Sciences discourse community seems to be closer to the Hard Sciences discourse community than the Humanities discourse community in methodology. Social Science literature shows a similar level of affinity for scientific methods compared to the Hard Sciences literature, with their regularized SAWM tag frequencies being relatively similar. On the other hand, despite the fact that the Social Sciences community is more interpretive than the Hard Sciences community, it is still fairly less interpretive than the Humanities community, which seems to go all in on interpretive methods. This contrasts the common idea that the Social Sciences and the Humanities should be grouped together.

Although the Social Sciences show similarities to both the Hard Sciences and the Humanities, the results also show that these similarities are not fully descriptive of it as its own discipline group. Social Sciences differ from the Hard Sciences and Humanities in that their distribution of SAWM frequency by document has much wider variety, indicating that there may not be widely-followed standards in the discourse community around how scientific their articles should be. Another possible explanation is that the Social Sciences encompass many disciplines with arguably different objectives. For instance, broadly speaking, psychology examines how people think, while decision science tries to find optimal solutions to decision problems. These objectives warrant different methodological approaches, leading to more variation in scientific methodology in the Social Science community at large.

Although this study provides insights about the relationship between methodological preferences in the academic Social Sciences, Hard Sciences, and Humanities communities, it has limitations, the largest of which is sample size. We used a random sample of the Elsevier corpus, which contains twenty documents from each of the twenty Elsevier academic discipline categories. The discipline categories are arguably not fully descriptive of the literature as a whole, and their boundaries can be unclear. The sample size limitation additionally means that, although the p-values of the statistical analysis found significant differences in the regularized tag frequencies between Hard Sciences, Social Sciences, and Humanities *within* the small sample, these differences cannot necessarily be extrapolated to the population of all academic literature.

We attempted to curb the sample size limitation by incorporating multiple disciplines under each group to artificially increase sample size. We used ten disciplines, i.e. two-hundred total documents by counting multiple disciplines under Social Sciences and Hard Sciences. However, this was not possible for the Humanities group, which only has one discipline category. Furthermore, even if all four-hundred documents in the sample could be used, it is still difficult to make any valid conclusions about the population of literature. This is especially true given the limitations of the DocuScope tool, which only provides aggregate calculations of statistics and

throws away intermediate calculations. If document-level calculations or counts were provided by the tool, more techniques would be available to the user. For instance, the bootstrap (Efron, 1979), which provides standard error estimates for statistics in small samples, would allow us to determine the stability of mean tag frequencies within a sample of documents.

Despite this study's limitations, it does provide possible directions for further research. For one, a larger sample of articles could be used to verify the generality of these findings to the entire population of academic literature. Additionally, we used the Citation Controversy and the SAWM tags as proxies for interpretive and scientific methodology, but other document-tagging methods to more directly measure these variables could be explored. We also saw one way in which the Social Sciences literature is distinct from the Hard Sciences and Humanities literature, but there are likely more ways to investigate the unique characteristics of Social Sciences. For instance, it may be insightful to investigate confidence-related language tags to determine how confident Social Sciences articles tend to be in their findings compared to Hard Sciences and Humanities.

In conclusion, we find⁵ evidence that the Social Sciences fall between the Hard Sciences and the Humanities on a methodological scale, but also that they are likely to have unique characteristics that can be explored in future research. The sense of a methodological scale reinforces the idea that standards around methodology and communication of study results are not fully unique per discipline. Although it is true that Humanities scholars should be educated in methods that are quite different from Hard Sciences scholars, the education of Social Sciences scholars should take a more well-rounded approach. In general, educational needs can readily be tailored to scholars by discipline in this way.

CODE AVAILABILITY

The code to reproduce the figures is available at <https://github.com/9Dread/76107ComparativeGenreAnalysis>.

⁵ Metadiscourse (first person)

References

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