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Argumentation in Philosophical Practice: An Empirical Study

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Abstract: Philosophers tend to think of themselves as model arguers and that the best kind of argument is deductive arguments, i.e., the most persuasive arguments where the premises provide the best evidence for conclusions. This raises the question: Do philosophers make the best type of arguments? If deductive arguments are indeed the best, and philosophers are model arguers, is it the case that philosophers make deductive arguments significantly more than other kinds of argument? We set out to investigate this question empirically. Using data mining and text analysis methods, we study a large corpus of philosophical texts mined from the JSTOR database ($n = 435,703$). Using indicator words to classify arguments by type (deductive, inductive, and abductive), we searched through our corpus to find patterns of usage. Our results suggest that deductive arguments were the most common type of argument in philosophy until the end of the twentieth century: significantly more common than abductive, but not inductive, arguments. Then, around 2008 a shift in methodology occurred, and inductive arguments took over as the most common type of argument. In addition, abductive arguments are becoming increasingly more popular in philosophy. Overall, our results suggest that deductive arguments are giving way to not only inductive arguments but also abductive arguments in philosophical practice.

Keywords: abductive argument, deductive argument, indicator words, inductive argument, metaphilosophy, philosophical practice

1. Introduction

Professional philosophers, especially academic philosophers working in the analytic tradition, tend to think of themselves as model arguers. For example, according to Lacewing (2014, p. 7), “At the heart of philosophy is philosophical argument.”¹ Similarly, Currie (2016, p. 200) says that “philosophers are careful folk, trained in the ways of argument.” In practice, too, professional philosophers generally agree that doing philosophy professionally (as opposed to amateurishly) means advancing arguments for and/or against philosophical theses. As Verene

¹ See also Martin (2017), Harrell (2016), and Taylor (1995).

(1989, p. 141) puts it, “That philosophy essentially depends on argument is taken as such common knowledge that to dispute it seems simply to abandon philosophy for some other form of thinking.” Similarly, Bruce and Barbone (2011, p. 1) express the point about the essence of academic philosophy being argumentation as follows: “‘Show me the argument’ is the battle cry for philosophers.” Moreover, the conviction that the heart of academic philosophy is argument also plays a role in philosophical argumentation itself. For instance, Cohen (2004, p. 117) argues that, “If argument is the heart of philosophy, then metaphor is its life-giving blood.”²

In addition to thinking of themselves as professional arguers, professional philosophers, especially academic philosophers working in the analytic tradition, tend to think that the best kind of argument is deductive arguments, i.e., the most persuasive arguments where the premises provide the best evidence for conclusions. For example, according to Bailey (2013, p. 6), “Good deductive arguments are the strongest possible kind of argument.” Similarly, Baggini and Fosl (2010, p. 14) write, “Deductive arguments may be thought of as the best kind of sausage machines because they *guarantee* their output.”³

All of this raises the following questions, which are the research questions that will guide our empirical study in this paper:

1. Do professional philosophers make the best type of arguments?
2. If deductive arguments are indeed the best, and professional philosophers are model arguers, is it the case that academic philosophers make deductive arguments significantly more than other types of argument?

We set out to investigate these questions empirically. Using data mining and text analysis methods, we study a large corpus of philosophical texts mined from the JSTOR database (n = 435,703). Using indicator words to classify arguments by type (namely, deductive, inductive, and abductive arguments), we searched through our corpus to find patterns of usage.

Before we report the results of our empirical study in Section 3, we describe our methodology in more detail in Section 2. In Section 4, we will discuss how the results of our empirical study provide tentative answers to our research questions (1) and (2) above. Overall, the results of our empirical study suggest that deductive arguments were the most common type of argument in philosophy until the end of the twentieth century: significantly more common than abductive arguments, but not inductive arguments. Then, around 2008, a shift in methodology occurred, and inductive arguments took over as the most common type of

² In *The Chronicle of Higher Education*, Oljar and Koukal (2019) write: “philosophy [is] a discipline that has been thinking about thinking since its inception. [...] Philosophers have spent centuries formulating logical principles that distinguish good reasoning from bad reasoning. Knowing the difference between premises and conclusions, factual claims and inferential claims, deductive and inductive arguments, and good from fallacious reasoning is vital for thinking seriously about thinking.”

³ In the following passage, Baggini and Southwell (2012, p. 6) seem to suggest that there is a hierarchy of argument types, with deductive arguments at the top, followed by inductive arguments, and abductive arguments at the bottom: “Here, abduction provided a temporary provisional solution until enough evidence could be gathered for an inductive explanation. But when it comes to issues such as whether God exists, or whether other people have minds, we may have to rely permanently on arguments to the best explanation. This form of argument is the best kind of rational account we can give for a conclusion *if it cannot be demonstrated by a deductive argument or if there is insufficient evidence to construct an inductive one*” (emphasis added).

argument. In addition, abductive arguments are becoming increasingly more popular in philosophy. Indeed, our results suggest that deductive arguments are giving way to not only inductive arguments but also abductive arguments in philosophical practice.

2. Methods

2.1 Background

Introductory textbooks to logic and reasoning typically contain a brief discussion of indicator words. There are premise indicators—words such as ‘because’ and phrases such as ‘inferred from’ and the like—which indicate a premise of an argument, and there are conclusion indicators—words such as ‘therefore’ and phrases such as ‘it follows that’ and the like—which indicate a conclusion of an argument. For example, Morrow and Weston (2011, p. 5) tell students to look for indicator words in order to distinguish between premises and conclusions. According to Morrow and Weston (2011, p. 5):

Some words or phrases are *conclusion indicators*. These are words or phrases that tell you that you’re about to read or hear the conclusion of an argument. Other words or phrases are *premise indicators*. These tell you that you’re about to read or hear a premise (emphasis in original).

They then provide a list of premise indicators, which includes words like ‘because’ and ‘this follows from’, and a list of conclusion indicators, which includes words like ‘therefore’ and ‘hence’ (Morrow and Weston 2011, p. 5).

In addition to helping students identify premises and conclusions of arguments, indicators also help students distinguish between deductive arguments and inductive arguments. For example, according to Baronett (2016, p. 23):

to help identify arguments as either deductive or inductive, one thing we can do is look for key words or phrases. For example, the words ‘necessarily,’ ‘certainly,’ ‘definitely,’ and ‘absolutely’ suggest a deductive argument. . . . On the other hand, the words ‘probably,’ ‘likely,’ ‘unlikely,’ ‘improbable,’ ‘plausible,’ and ‘implausible’ suggest inductive arguments.

Similarly, according to Hurley (2016, p. 31), “inductive indicators” include terms and phrases such as ‘probably’, ‘improbable’, ‘plausible’, ‘implausible’, ‘likely’, ‘unlikely’, and ‘reasonable to conclude’, whereas “deductive indicators” include terms and phrases such as ‘it necessarily follows that’, ‘certainly’, ‘absolutely’, and ‘definitely’.

We can use these deductive indicators and inductive indicators, then, to look for deductive arguments and inductive arguments in philosophical texts in much the same way that students use them to look for arguments in any text. To the aforementioned deductive and inductive indicators, we can also add indicators for abductive arguments, i.e., arguments in which the conclusion is supposed to be the best explanation for some phenomenon (Govier 2010, pp. 298-302). Abductive indicators include phrases such as ‘account for’, ‘best explain’, ‘make

sense of’, and ‘best explanation for’ (Overton 2013). The types of arguments we searched for in this empirical study and their associated indicators are listed in Table 1.

Table 1. Types of arguments and their indicator words with examples from philosophical texts

Argument Types	Indicators	Examples
<i>Abductive</i>	account for, best explain, makes sense of, best explanation for	“We infer that middle-sized objects exist, because their existence <i>provides the best explanation for</i> the patterns in our sense experience” (Trout 1998, p. 97).
<i>Deductive</i>	absolutely, certainly, definitely, necessarily	“if, as he says, such an infinite series really is impossible then it does <i>absolutely follow that</i> if anything exists in time at all, there must have been a moment, before which nothing existed” (Moore 1954, p. 175).
<i>Inductive</i>	likely, unlikely, probably, improbable	“Whatever may be the case for lesser breeds without the law, the nature of ‘open’ and— <i>sotto voce</i> —Western societies is such that conspiracy theories involving Western governments are unlikely to be true, and <i>hence unlikely</i> to be justified” (Pigden 2017, p. 123).

In order to make sure that our indicators for argument types (see Table 1) actually indicate arguments in the corpus, we anchored them to argument indicators, such as ‘therefore’ and ‘hence’. This procedure results in the argument indicator pairs listed in Table 2.

Table 2. Indicator pairs for deductive, inductive, and abductive arguments

Deductive indicator pairs	Inductive indicator pairs	Abductive indicator pairs
therefore necessarily	therefore probably	therefore account for
therefore certainly	therefore likely	therefore best explain
therefore definitely	therefore unlikely	therefore make sense of
therefore absolutely	therefore improbable	therefore best explanation for
hence necessarily	hence probably	hence account for
hence certainly	hence likely	hence best explain
hence definitely	hence unlikely	hence make sense of
hence absolutely	hence improbable	hence best explanation for
so necessarily	so probably	so account for
so certainly	so likely	so best explain
so definitely	so unlikely	so make sense of
so absolutely	so improbable	so best explanation for
consequently necessarily	consequently probably	consequently account for
consequently certainly	consequently likely	consequently best explain
consequently definitely	consequently unlikely	consequently make sense of
consequently absolutely	consequently improbable	consequently best explanation for

proves necessarily	proves probably	proves account for
proves certainly	proves likely	proves best explain
proves definitely	proves unlikely	proves make sense of
proves absolutely	proves improbable	proves best explanation for
thus necessarily	thus probably	thus account for
thus certainly	thus likely	thus best explain
thus definitely	thus unlikely	thus make sense of
thus absolutely	thus improbable	thus best explanation for
follows necessarily	follows probably	follows account for
follows certainly	follows likely	follows best explain
follows definitely	follows unlikely	follows make sense of
follows absolutely	follows improbable	follows best explanation for
accordingly necessarily	accordingly probably	accordingly account for
accordingly certainly	accordingly likely	accordingly best explain
accordingly definitely	accordingly unlikely	accordingly make sense of
accordingly absolutely	accordingly improbable	accordingly best explanation for
infer necessarily	infer probably	infer account for
infer certainly	infer likely	infer best explain
infer definitely	infer unlikely	infer make sense of
infer absolutely	infer improbable	infer best explanation for

By searching for these argument indicator pairs (as listed in Table 2) in our corpus, we can find out what types of arguments philosophers make in their published works and with what frequency. This would help us find answers to research questions (1) and (2) above.

2.2 Text-Mining Methods

A combination of several text-mining packages in R Language were used to manipulate the corpus of philosophical texts throughout this study. RStudio was used as an interactive-development environment to process the data. The corpus of documents included a .txt file containing the full-text of the philosophical work, and a corresponding .xml file to the full-text file comprised of metadata information about each text file.

The *readtext* package was utilized to load the text files into the RStudio environment. The *readtext* function takes a folder path as an input parameter (i.e. *readtext*("filepath"). The *readtext()* function will then load all files in the target folder into RStudio as a dataframe. The dataframe will consist of two columns.

The first column is titled "doc_id," which lists the file names as individual elements within a string vector. The second column is titled "text" and includes the full-text from each of the individual text files as single character string. The result is a vector of character strings, with each string containing the full-text of an input text file. The .xml files were converted to .txt files from the Terminal application and also read into R using the *readtext()* function.

To search for indicator pairs within the full-text documents, the *string_detect()* function from the *stringr* package was used in combination with a regular expression as a pattern search

parameter. The argument indicator root and anchor were included within the regular expression to search for specific words.

The regular expression pattern allowed for the root of the argument indicator pairs to both precede and follow the anchor word(s) within a certain range of words, exclusively. The function was applied to the corpus across three word-ranges. The ranges selected permitted 3, 6, or 10 words between the argument indicator root and the anchor word(s). For example, to search for pattern matches across a range of 3 words, the regular expression returns a positive match in the following cases:

Root word1 word2 word3 Anchor | OR | *Anchor word1 word2 word3 Root*

Any pattern in which the argument indicator roots and anchors are separated by less than the maximum range (i.e., 3, 6, or 10) is also considered a positive match. For example, as applied within a 3-word maximum range, the following case would be considered a positive match:

Anchor word1 word2 Root

Applied in this manner, the *string_detect()* function will return a list of TRUE or FALSE logical values, where TRUE indicates the presence of the argument indicator and the anchor at least one time within each document and FALSE indicates no pattern match. The logical values were then converted to numeric data, with 1 replacing TRUE and 0 replacing FALSE. This detection process was repeated for each indicator pair for each of the deductive, inductive, and abductive lists and across all three-word ranges. The resulting lists were then summed, and the number of positive matches were recorded to a separate .csv file.

Separate .csv files containing matched full-text documents across each of the word-ranges were also generated from these lists. Publication years were extracted from the metadata files (previously .xml files) using the *str_extract()* function from the *stringr* package. As with the indicator pair matches, a regular expression was used to isolate XML tags containing the publication years for each document from the metadata files and paired with the corresponding positively matched full-text files. The number of positively matched documents by year in proportion to the number of documents in the whole corpus ($n = 435,703$) was then calculated. A regression analysis was then performed on the resulting ratios of positively matched documents across each word range.

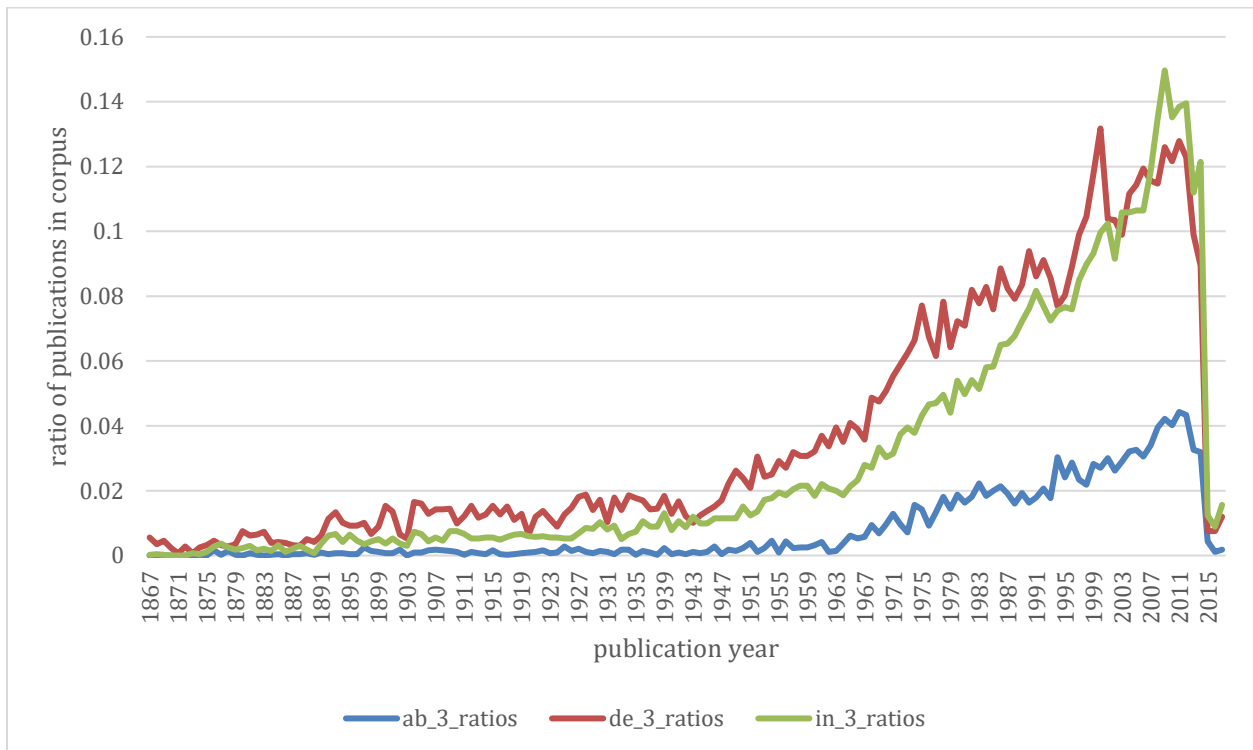
3. Results

In searches permitting three words between argument indicator root and anchor, the ratio of philosophy publications advancing deductive arguments is always higher than those advancing abductive arguments and almost always higher than those advancing inductive arguments. With regards to the latter, however, the ratios appear to be converging over time, with more recent years showing slightly higher ratios of inductive arguments than deductive arguments in philosophy publications.

An independent-samples t-test was conducted to compare the ratios of deductive arguments and the ratios of abductive arguments from the results for searches allowing a 3-word maximum range. There was a significant difference between deductive arguments ($M = 0.03$, $SD = 0.03$) and abductive arguments ($M = 0.008$, $SD = 0.01$), $t(178) = -9.17$, $p < 0.00$, two-tailed. Likewise, an independent-samples t-test was conducted to compare the ratios of deductive arguments and the ratios of inductive arguments from the results for searches allowing a 3-word maximum range. There was no significant difference between deductive arguments ($M = 0.03$, $SD = 0.03$) and inductive arguments ($M = 0.02$, $SD = 0.03$), $t(300) = 1.79$, $p = 0.07$, two-tailed. These results suggest that philosophers make deductive arguments significantly more than abductive argument, but not significantly more than inductive arguments.

We also looked at linear models of the differences in ratios between deductive arguments, inductive arguments, and abductive arguments (see Figure 1).

Figure 1. Ratios of philosophy publications in the JSTOR corpus with deductive, inductive, and abductive arguments permitting three words between argument indicator root and anchor



When we look at deductive arguments and abductive arguments over the years (1867-2017), the equation for the line is $y = 3.1304x + 0.0123$. Given that $R^2 = 0.91$, we can say that 91% of the variance in deductive arguments is explained by the model, the standard of error of the estimate is 0.011. Since $p < 0.00$, we can conclude that the regression model is a significantly good fit. Similarly, when we look at deductive arguments and inductive arguments over the years (1867-2017), the equation for the line is $y = 0.9682x - 0.0087$. Given that $R^2 = 0.93$, we can say that 93% of the variance in deductive arguments is explained by the model, the standard of error

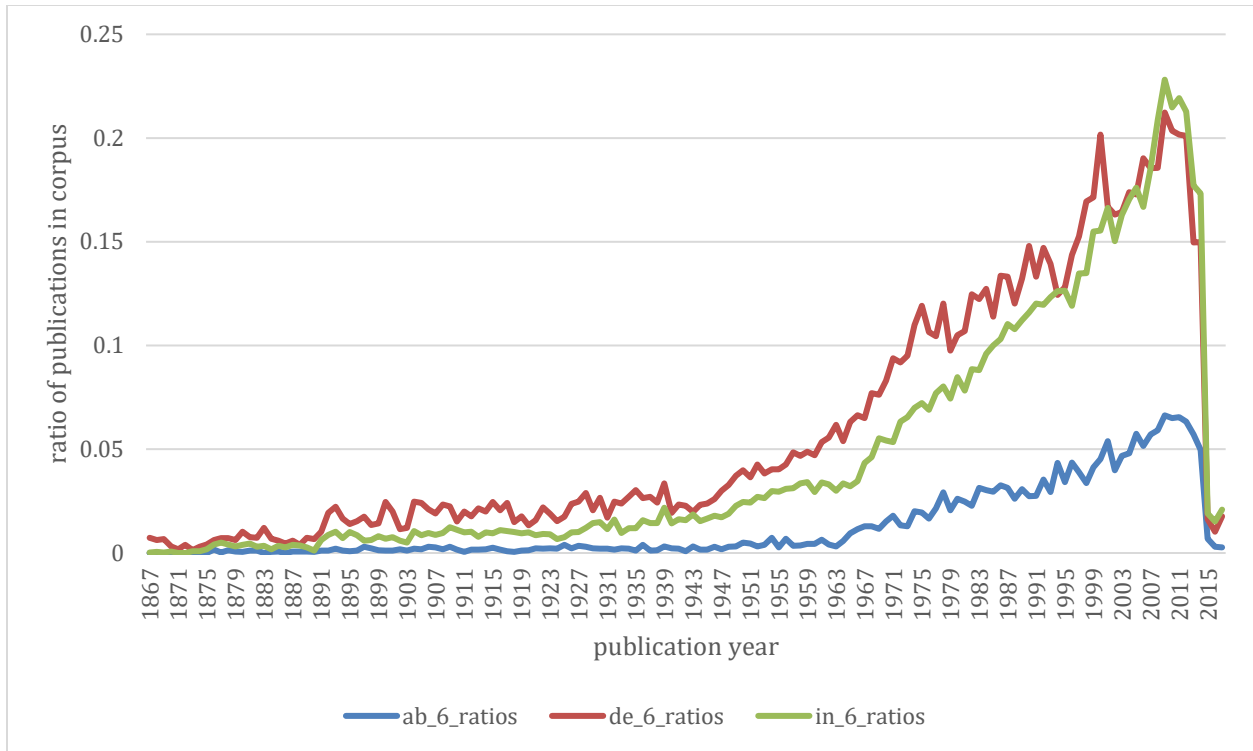
of the estimate is 0.009. Since $p < 0.00$, we can conclude that the regression model is a significantly good fit.

In searches permitting six words between argument indicator root and anchor, the ratio of philosophy publications advancing deductive arguments is always higher than those advancing abductive arguments and almost always higher than those advancing inductive arguments. With regards to the latter, however, the ratios appear to be converging over time, with more recent years showing slightly higher ratios of inductive arguments than deductive arguments in philosophy publications. This pattern is similar to the one exhibited by the data from our 3-word searches.

An independent-samples t-test was conducted to compare the ratios of deductive arguments and the ratios of abductive arguments from the results for searches allowing a 6-word maximum range. There was a significant difference between deductive arguments ($M = 0.05$, $SD = 0.05$) and abductive arguments ($M = 0.01$, $SD = 0.01$), $t(177) = -9.15$, $p < 0.00$, two-tailed. Likewise, an independent-samples t-test was conducted to compare the ratios of deductive arguments and the ratios of inductive arguments from the results for searches allowing a 6-word maximum range. There was no significant difference between deductive arguments ($M = 0.05$, $SD = 0.05$) and inductive arguments ($M = 0.04$, $SD = 0.05$), $t(300) = 1.72$, $p = 0.08$, two-tailed. These results, which are consistent with the results obtained from our 3-word searches, suggest that philosophers make deductive arguments significantly more than abductive argument, but not significantly more than inductive arguments.

As we did for our 3-word searches, we also looked at linear models of the differences in ratios between deductive arguments, inductive arguments, and abductive arguments (see Figure 2).

Figure 2. Ratios of philosophy publications in the JSTOR corpus with deductive, inductive, and abductive arguments permitting six words between argument indicator root and anchor



When we look at deductive arguments and abductive arguments over the years (1867-2017), the equation for the line is $y = 3.1956x - 0.0184$. Given that $R^2 = 0.92$, we can say that 92% of the variance in deductive arguments is explained by the model, the standard of error of the estimate is 0.016. Since $p < 0.00$, we can conclude that the regression model is a significantly good fit. Similarly, when we look at deductive arguments and inductive arguments over the years (1867-2017), the equation for the line is $y = 0.9868x - 0.0124$. Given that $R^2 = 0.95$, we can say that 95% of the variance in deductive arguments is explained by the model, the standard of error of the estimate is 0.012. Since $p < 0.00$, we can conclude that the regression model is a significantly good fit.

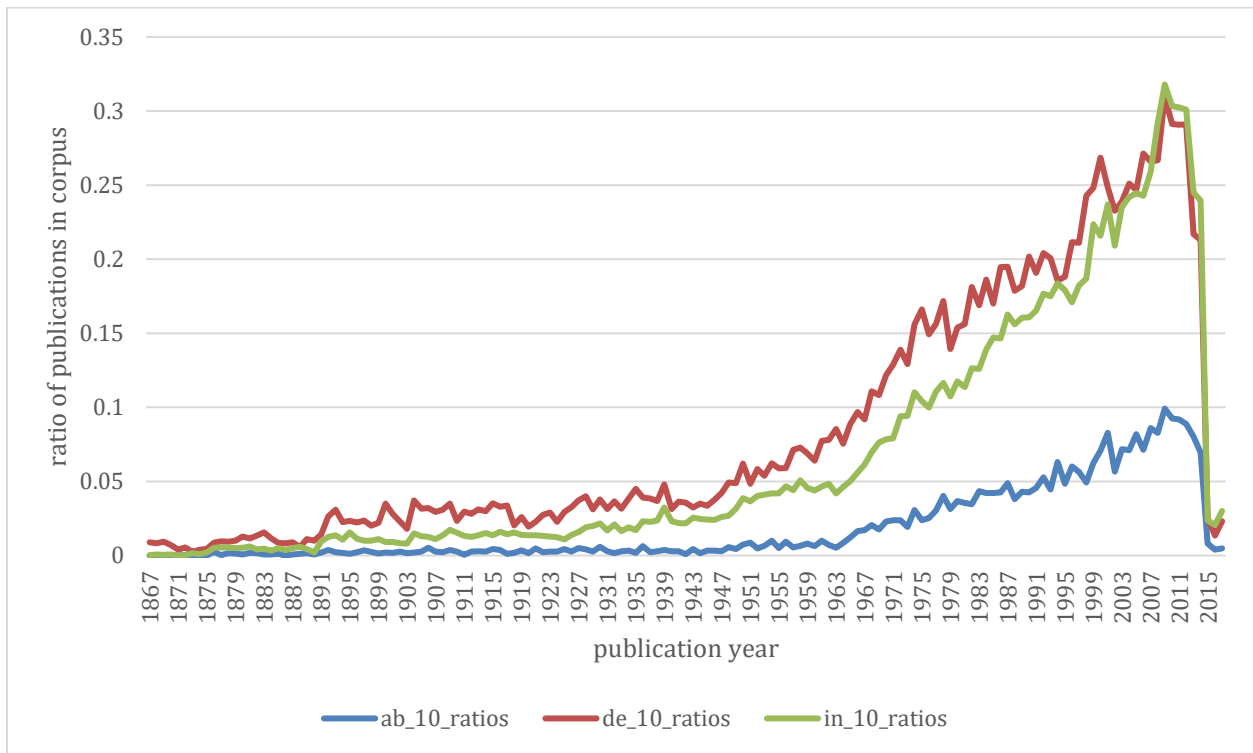
Finally, in searches permitting ten words between argument indicator root and anchor, the ratio of philosophy publications advancing deductive arguments is always higher than those advancing abductive arguments and almost always higher than those advancing inductive arguments. With regards to the latter, however, the ratios appear to be converging over time, with more recent years showing slightly higher ratios of inductive arguments than deductive arguments in philosophy publications. Again, this pattern is similar to the ones exhibited by the data from our 3-word and 6-word searches.

An independent-samples t-test was conducted to compare the ratios of deductive arguments and the ratios of abductive arguments from the results for searches allowing a 10-word maximum range. There was a significant difference between deductive arguments ($M = 0.08$, $SD = 0.08$) and abductive arguments ($M = 0.01$, $SD = 0.02$), $t(178) = -9.16$, $p < 0.00$, two-tailed. Likewise, an independent-samples t-test was conducted to compare the ratios of deductive arguments and the ratios of inductive arguments from the results for searches allowing a 10-word maximum range. There was no significant difference between deductive arguments ($M = 0.08$,

SD = 0.08) and inductive arguments (M = 0.06, SD = 0.08), $t(300) = 1.81$, $p = 0.07$, two-tailed. These results, which are consistent with the results obtained from our 3-word and 6-word searches, suggest that philosophers make deductive arguments significantly more than abductive argument, but not significantly more than inductive arguments.

As we did for our 3-word and 6-word searches, we also looked at linear models of the differences in ratios between deductive arguments, inductive arguments, and abductive arguments (see Figure 3).

Figure 3. Ratios of philosophy publications in the JSTOR corpus with deductive, inductive, and abductive arguments permitting ten words between argument indicator root and anchor



When we look at deductive arguments and abductive arguments over the years (1867-2017), the equation for the line is $y = 3.1796x + 0.0259$. Given that $R^2 = 0.93$, we can say that 93% of the variance in deductive arguments is explained by the model, the standard of error of the estimate is 0.021. Since $p < 0.00$, we can conclude that the regression model is a significantly good fit. Similarly, when we look at deductive arguments and inductive arguments over the years (1867-2017), the equation for the line is $y = 1.0072x + 0.0171$. Given that $R^2 = 0.96$, we can say that 96% of the variance in deductive arguments is explained by the model, the standard of error of the estimate is 0.016. Since $p < 0.00$, we can conclude that the regression model is a significantly good fit.

4. Discussion

As discussed in Section 1, our empirical study was designed to address the following questions about argumentation in philosophical practice:

1. Do professional philosophers make the best type of arguments?
2. If deductive arguments are indeed the best, and professional philosophers are model arguers, is it the case that academic philosophers make deductive arguments significantly more than other types of argument?

The results of our empirical study suggest the following tentative answers to these research questions. As far as question (1) is concerned, our results suggest that philosophers do make deductive arguments in their published work. Insofar as deductive arguments are considered by many philosophers to be the best type of argument (see Section 1 for discussion), we can say that philosophers do make the best type of arguments. When it comes to question (2), the results of t-tests suggest that, on average, philosophers have made significantly more deductive arguments than abductive arguments in their published work overall, but not inductive arguments. As we have seen, no significant differences were found between the ratios of deductive arguments and inductive arguments in our corpus. According to our results, then, it is the case that academic philosophers make deductive arguments significantly more than abductive arguments, but it is not the case that academic philosophers make deductive arguments significantly more than inductive arguments. Since we have observed these patterns in our 3-word, 6-word, and 10-word search results, we can be quite confident that these results are robust.

Furthermore, our results also suggest that a methodological change may be taking place in philosophical practice. In particular, while deductive arguments were significantly more common than abductive arguments and more common (but not significantly so) than inductive arguments until the beginning of the twenty-first century, a shift in methodology seems to have occurred around 2008, when inductive arguments have taken over as the most common type of argument and abductive arguments have started to gain in popularity as well. In other words, our results suggest that deductive arguments are gradually giving way to inductive arguments and abductive arguments in philosophical practice. This finding is supported by linear models that show inductive arguments and abductive arguments significantly accounting for the variation in deductive arguments over the years.

In that respect, our findings are in line with the results of other empirical studies on argumentation in philosophical practice. In one empirical study, Knobe (2015) compared two samples of papers on philosophy of mind: one sample of papers from 1960 to 1999 and another sample of papers from 2009 to 2013. Knobe (2015) found that 62% of the papers from the 1960-1999 sample used purely a priori methods, whereas only 12% of the papers from the 2009-2013 sample used purely a priori methods. This evidence leads Knobe (2015, p. 38) to conclude that there has been “a strong shift [in method] toward the use of systematic empirical data, including original experiments conducted by philosophers [i.e., experimental philosophy].”

In another empirical study, Ashton and Mizrahi (2018) test the view that philosophy is essentially an a priori discipline empirically. According to Ashton and Mizrahi (2018, p. 62), “if philosophy is indeed a priori, and in the business of discovering necessary truths from the armchair, we would expect philosophers to advance mostly deductive, not inductive, arguments.”

Consistent with the view that philosophy is an a priori discipline, Ashton and Mizrahi (2018) find that the proportion of philosophy papers in which deductive arguments are made is higher than that of philosophy papers in which inductive arguments are made. However, contrary to the view that philosophy is an a priori discipline, Ashton and Mizrahi (2018) also find that the proportions of philosophy papers in which deductive arguments are made and those in which inductive arguments are made are converging over time and that the difference between the ratios of inductive arguments and deductive arguments is declining over time. As Ashton and Mizrahi (2018b, pp. 68-69) put it, their results suggest that “deductive arguments are gradually losing their status as the dominant form of argumentation in philosophy.”

The interesting thing about our results, which differentiates them from the results obtained by Knobe (2015) and those obtained by Ashton and Mizrahi (2018), is that they suggest that abductive arguments explain the shift away from deductive arguments almost as much as inductive arguments do. In other words, deductive arguments seem to be giving way to not only inductive arguments but also abductive arguments in philosophical practice. These patterns were observed in our 3-word, 6-word, and 10-word datasets, which is why we can be quite confident that these results are robust. Moreover, since our results were obtained from a survey of a large corpus of philosophical texts mined from the JSTOR database (n = 435,703), we can be quite confident that they are representative of philosophical practice. In that respect, our results suggest that we should expect inductive arguments and abductive arguments to become more prevalent in philosophical publications at the expense of deductive arguments.

Acknowledgments

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