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# Linguistic aspects of the scientific research article in 1715 with particular reference to two astronomy articles

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**Abstract:** Astronomy is the most important subject treated in the *Philosophical Transactions* and the *Mémoires de l'Académie Royal* in 1715. Articles by Halley and Maraldi have been selected for analysis. The process type profiles of the two articles are very similar. The object of study is the most important type of theme in both, but the proportion of themes of this type in Maraldi's text is much greater than that in Halley's. Surprisingly, temporal themes play a significant role in Halley's text. Also surprising is the fact that, in Halley's text, adjunct themes are more frequent than subject themes. Nominalized processes tend to be material rather than mental, but the difference is greater in Halley's text than in Maraldi's. First person pronoun subjects tend to occur with mental process verbs, but whereas in Halley's text material processes also play a part, there are hardly any in Maraldi's text. These linguistic differences between the two texts can be explained in terms of their differing stances, that of Halley being Baconian and hence empirical, that of Maraldi being Cartesian and hence deductive.

**Keywords:** astronomy; early eighteenth century; first person pronoun; nominalization; process type; theme

## 1 Introduction

The *Philosophical Transactions* began publishing in London in 1665 and still exists. In its long history it has only had one editor who has fulfilled that function for two periods: Edmund Halley who was editor from 1686 till 1691, and then again from 1714 to 1719. The *Académie Royale des Sciences* was founded in Paris in 1666, but until the end of the century its publications were luxurious editions which were technically considered to be the property of the King, and often difficult to obtain (Licoppe 1994). It was only in 1699 that the decision to publish on a wider basis was taken, and the first volume actually appeared in 1702 (Banks 2017a). It was common at this period

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for publications to have unwieldy titles, and neither of these escaped the trend. The full title of the *Philosophical Transactions* was *Philosophical Transactions giving some account of the present undertakings, studies, and labours of the ingenious in many considerable parts of the world*.<sup>1</sup> That of the *Académie Royal* publication was *Histoire de l'Académie Royale des Sciences avec les mémoires de mathématiques & de physique pour la même année, tirés des registres de cette Académie*.<sup>2</sup>

These two can be considered to be the only two scientific periodicals publishing in a vernacular language in the early eighteenth century. Other academic periodicals, such as the *Journal des Scavans* (Banks 2015, 2017b; Morgan 1928) and the *Mémoires pour l'histoire des sciences et des beaux-arts* (Banks in press), covered the whole range of academic disciplines, including religion, history and law, so cannot be considered to be strictly scientific. The *Acta Eruditorum* published in Latin. For the purposes of considering scientific periodical publications, it is therefore the *Philosophical Transactions* and the *Mémoires* of the *Académie Royale* that are appropriate. I have taken the year 1715, more or less at random, for this purpose.

Previous studies of late seventeenth and early eighteenth century scientific writing have tended to be from a sociolinguistic point of view (Atkinson 1999; Bazerman 1988; Gross 1996; Valle 1999), or in the domain of the history of science (Hall 2002; Kronick 1962; Lyons 1944), including the recent extensive study by Fyfe et al. (2022). Gross et al. (2002) has a slightly more linguistic bent, but non-English texts are given only in English translation showing that they are interested in what is said rather than how it is said. Of the rare edited volumes in this area, Taavitsainen and Pahta (2011) deals with medical texts in the sixteenth to the eighteenth century, and Moskovich and Crespo (2012) deals with texts in astronomy from 1700 to 1900. However, studies giving detailed analysis of linguistic features in such texts, as I have attempted to do in my own work (e.g. Banks 2008, 2015, 2017b, 2024) are rare. This paper is an attempt to contribute to this area of study.

## 2 Methodology and texts selected for analysis

In the year 1715, Halley produced 5 issues of the *Philosophical Transactions*, printing 25 items for a total of 216 pages, and an average of 8.6 pages per item. Of these, four items, accounting for 19 pages were printed in Latin. The details are shown in Table 1.

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1 The texts published in the *Philosophical Transactions* can be found on the website of the Royal Society (<https://royalsociety.org>).

2 The texts published in the *Mémoires* can be found on the website of the *Bibliothèque Nationale de France* (<https://gallica.bnf.fr>).

**Table 1:** Contents of *Philosophical Transactions*.

Contents	Items	Pages	Average pages per item
Astronomy	6	40	6.7
Mathematics	4	60	15.0
Geography	4	35	8.8
Botany	3	44	14.7
Archaeology & antiquities	3	23	7.7
Medicine & anatomy	3	9	3.0
Physics	2	5	2.5
<b>Total</b>	<b>25</b>	<b>216</b>	<b>8.6</b>

The two subjects that attracted the greatest attention were astronomy and mathematics. There are 6 items dealing with astronomical matters, accounting for 40 pages. Of these, 3 are in Latin, covering 16 pages, so 40 % of the astronomical material is in Latin, indicating that astronomers, despite the waning use of Latin, were still expected to be competent in that language. For mathematics, there is a smaller number of items, but a greater total number of pages. This is largely due to a single book notice of 52 pages. It will be remembered that the dispute between Newton and Leibniz over the invention of differential calculus was raging during this period. Moreover, Newton was himself President of the Royal Society from 1703 to 1727. The book in question is a Royal Society publication and naturally supports Newton's claims.

Of the 25 items, 13 are articles and seven book notices. The details are given in Table 2.

**Table 2:** Genre of items in the *Philosophical Transactions*.

Genre	Items	Pages	Average pages per item
Article	13	101	7.8
Book notice	7	88	12.6
Letter	3	22	3.1
Observations	1	10	10.0
Paper	1	5	5.0
<b>Total</b>	<b>25</b>	<b>216</b>	<b>8.6</b>

The letters are those that are specifically said to be letters in the headings, and the one paper is specifically said to have been read at the Royal Society, but otherwise these are very similar to articles, and it may be the case that those classed as articles may be extracts from letters or papers that had been read, without their specifically

being labelled as such. On the other hand those said to be letters are considerably shorter than those classed as articles, and the single paper falls between the two. Articles make up 52 % of the items and 47 % of the pages, while book notices make up 28 % of the items but 41 % of the pages. This is again mainly due to the 52-page mathematical book notice. Other than that one, the longest book notice is 14 pages, and four of them are four pages or less.

Of the 13 articles, four deal with astronomy, whereas only one of the seven book notices does. In addition, there are three articles on botany and two on physics, but no book notices dealing with these subjects. On the other hand, three of the seven book notices deal with mathematics, while there is only one article of this subject. So, it would seem that some subjects, like astronomy, botany and physics, lend themselves to the article form, while others, like mathematics, lend themselves to the book form, and thus arrive in the periodical in the form of a book notice.

The *Histoire de l'Académie Royale des Science avec les mémoires de mathématiques & de physique* is divided into two parts. The first, *Histoire*, is the proceedings of the meetings of the *Académie Royale*. The second, *Mémoires*, is made up of contributed papers, and it is this part that corresponds to a periodical like the *Philosophical Transactions*. However, whereas anyone could send material to the English journal, though it would not necessarily be published, those printed in the *Mémoires* were exclusively by members of the *Académie Royale* and all fit into the article genre. In 1715, the *Mémoires* printed 35 items for a total of 275 pages. The details are shown in Table 3.

**Table 3:** Contents of *Mémoires*.

Contents	Items	Pages	Average pages per item
Astronomy	22	113	5.1
Physics	4	43	10.8
Medicine	4	40	10.0
Geology	1	29	29.0
Mathematics	1	23	23.0
Chemistry	1	18	18.0
Botany	1	6	6.0
Meteorology	1	3	3.0
<b>Total</b>	<b>35</b>	<b>275</b>	<b>7.9</b>

It is clear that the contents of the *Mémoires* is dominated by astronomy which accounts for 63 % of the items, and 41 % of the pages. Even though the astronomy items tend to be shorter than other subjects, they still occupy pride of place in the

periodical. This may partly be due to astronomical phenomena which attracted the attention of members of the *Académie* during this year. An eclipse of the sun on 3 May is the subject of no less than seven items. There was also an eclipse of Venus by the Moon on 28 June which gave rise to three items, an eclipse of Jupiter by the Moon on 25 July which gave rise to four, and an eclipse of the Moon on 11 November which is the subject of one item. So these astronomical phenomena accounted for roughly two-thirds of the astronomical items.

It is also noticeable that much of the contents of the *Mémoires* is due to a small number of members of the *Académie*. One of the papers is co-signed by three authors, but all the others are single-authored. There is a total of 16 authors, but while 11 of these supplied just one item, Cassini supplied eight (one as co-author), de la Hire six, and Maraldi and Delisle five each (in Maraldi's case, one as co-author). The Cassini in question is Jacques Cassini, a member of the Cassini dynasty. His father, Giovanni Domenico Cassini had been recruited by Colbert, and his son César-François Cassini, and grandson, Dominique Cassini, would follow in his footsteps. There are 22 astronomy items one of which has three co-authors, thus giving potentially 24 authors. However, this includes the eight by Cassini, the five each by Maraldi and Delisle, and four of those by de la Hire, so other than these four, there are only two authors contributing a single astronomy paper, and one of these is only co-author. Hence the concentration on astronomical subjects would seem to be a combination of appropriate astronomical phenomena and the interests of a small number of *Académie* members.

Since astronomy is clearly the dominant subject in the *Mémoires*, accounting for 68 % of the items and 41 % of the pages, while in the *Philosophical Transactions* it accounts for the highest number of items, though not the highest number of pages, I shall in what follows consider in detail one astronomy item from each of the two journals. That means that the analyses which follow are case studies, and it would be imprudent to attempt any sort of extrapolation. On the other hand, there is no reason to suppose that they are not representative. However, it is obvious that further study will be necessary to show to what extent this might be the case.

In the *Philosophical Transactions*, three of the six items are in Latin, and two of the others are quite short. I have therefore taken, for more detailed consideration, the 18-page item entitled “*III. Observations of the late Total Eclipse of the Sun on the 22nd of April last past, made before the Royal Society at their House in Crane-Court in Fleet-street, London. By Dr. Edmund Halley, Reg. Soc. Secr. With an Account of what has been communicated from abroad concerning the same*” (italics in the original). This piece concerns the eclipse of the sun which took place on 22 April 1715. Halley gives a detailed account of his own observations of the eclipse made from the Royal Society's premises at Crane Court, London. In this paper, the exact times when the eclipse began and ended are treated as being of critical importance. He then goes on

to give summaries of accounts from various parts of the country. From this, he attempts to determine not only the times of the eclipse at various geographical points, but also the path which it followed as it passed over England.

In the *Mémoires*, I have taken the first astronomy item of comparable length. This is the 13-page item entitled “*OBSERVATIONS SUR LA PHASE RONDE DE SATURNE*. Par M. MARALDI” (italics and small capitals in the original). This piece concerns the rings of Saturn. Galileo, who discovered the rings of Saturn, referred to them as “ears”, and this piece alternates between calling them ears (*anses*) and rings (*anneaux*). With the telescopes of the period, the ears seemed to appear and disappear at regular intervals. Maraldi attempts to determine the periods when the ears are visible and to predict when they will reappear in the future.

In what follows, I shall consider the process types of finite verbs, the nature of themes (that is what they refer to), and their grammatical forms, nominalized processes, and first person pronoun subjects. This paper is therefore, as pointed out above, more like two case studies since it only deals with two texts. However these texts deal with the major subject treated in the *Philosophical Transactions* and the *Mémoires of the Académie Royale*, that is, astronomy. It is therefore a contribution to our understanding of the way scientific texts were written in the early eighteenth century.

### 3 Process types

In Systemic Functional Linguistics (SFL) (Banks 2017c, 2019; Halliday and Matthiessen 2014), the transitivity of a clause concerns the relationships between a process, the actors in that process, and, if they are expressed, the attendant circumstances. The process, realized in English and French by a finite verb, is particularly significant since it is the node of this organization of the clause. Processes can be expressed by non-finite verbal forms and nominalized processes, but these are subordinate to the finite verb. Nominalized processes will be considered later in this paper. I shall for the moment, therefore, concentrate on finite verbs. I use a system of five process types, derived from those commonly used in SFL. These are material, mental, relational, verbal and existential. Material processes are actions or events of a physical nature.

- (1) [...] and all around us, so much of the Segment of our Atmosphere as was above the Horizon and was without the Cone of the Moon's Shadow, **was** more or less **enlightened** by the Sun's Beams: and its Reflection **gave** a diffused Light

which **made** the Air seem hazey, and **hindred** the Appearance of the Stars.<sup>3</sup> (Halley 1715: 250)

Mental processes are events of a cerebral nature, including those of a cognitive, and those of a perceptive type.

(2) And the like may be said for the Velocity, which, though in our present Instance it was continually decreasing, **may**, for so short a time, **be supposed** to have been the same without sensible error. (Halley 1715: 260)

Relational processes are those which link two entities, or an entity with one of its characteristics.

(3) Whatever it **was**, this Ring **appeared** much brighter and whiter near the body of the Moon than at a distance from it; and its outward Circumference, which **was** ill defined, **seemed** terminated only by the extream Rarity of the Matter it **was composed** of, and in all Respects **resembled** the Appearance of an enlightened Atmosphere viewed from far: but whether it **belonged** to the Sun or Moon I shall not at present undertake to decide. (Halley 1715: 249)

Verbal processes are process of communication.

(4) And since he **has been informed** that it was just total in *Barnsdale*, three Miles South from thence. (Halley 1715: 257)

Existential processes are statements of existence.

(5) There **were** also present several foreign Gentlemen, and among them Monsieur *le Chevalier de Louville* and Mr. *Monmort*, both of them Members of the *Royal Academy of Sciences at Paris* [...]. (Halley 1715: 251)

Those familiar with SFL will notice that I do not use the category of behavioural process, which I consider to be an incoherent category. The reasons for this are explained in detail in Banks 2016. Thus, for example, all processes of communication, whether or not they project (are followed by direct or indirect speech) are here considered to be cases of verbal process. To the extent that interpretation of process types can range from grammatical to semantic (O'Donnell et al. 2008), my understanding of process types is towards the semantic pole of that cline.

The analysis of process types for these two articles is shown in Table 4.

The process type profiles of these two articles are almost identical, showing that from this point of view, there is little difference between the two articles. There is

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3 Relevant parts of examples are printed on **bold**.

**Table 4:** Process types in the two documents.

Process types	<i>Philosophical Transactions</i>	<i>Mémoires</i>
Materiel process	126 (32.14 %)	127 (32.32 %)
Mental process	101 (25.77 %)	98 (24.94 %)
Relational process	144 (36.73 %)	155 (39.44 %)
Verbal process	15 (3.83 %)	9 (2.29 %)
Existential process	6 (1.53 %)	4 (1.01 %)
<b>Total</b>	392 (100 %)	393 (100 %)

never more than two percentage points between the two profiles. The commonest process type in each is relational (36.73 %/39.44 %), showing that there is primary interest in establishing what is the case. The second most common is material. These are most commonly physical movements in the astronomical phenomena being studied. Also fairly significant, although third most common, are mental processes, which account for roughly a quarter (25.77 %/24.94 %) of the processes. Virtually all the examples of mental process are either cognitive or perception. In Halley's text, the cognitive type dominates, accounting for roughly 70 % of the mental processes. In Maraldi's text, perception and cognitive types occur in similar numbers, the perception type being only slightly more numerous than the cognitive. Verbal and existential processes, on the other hand, are rare.

## 4 Theme: semantic type

The thematic structure of a clause is seen in terms of a theme and a rheme, where the theme is defined as the speaker's starting point, and realized in English and French by the first major component (subject, circumstantial adjunct, predicate or complement). For the analysis of themes, I have used categories originally developed in Banks (2008). Those relevant to this study are the following. Obj is the object or phenomenon under study.

(6) And **the greatest Duration of total Darkness having been 3', 57"** (as was before shewn) it will follow, that the Diameter of the Elliptick Figure according to which the Shade past, was no less than  $114\frac{1}{2}$  Geogr. Miles. (Halley 1715: 260)

Obs is the action of observation of an object or phenomenon.

(7) **From these Observations** we may conclude that this Limit came upon the Coast of *England*, about the middle between *Newhaven* and *Brightelmston*, in *Sussex*, and passing by *Cranbrook* and *Boston*, left *Canterbury* about 4 Miles on

the Right hand, and quitted the Coast of *Kent*, not far from *Hern* toward the antient *Regulbium*, now called *Reculver*. (Halley 1715: 256–257)

Auth is a reference to the author or a group to which he belongs (including, for the French text, inclusive uses of the impersonal pronoun, *on*).

(8) **I** forbear to mention the *Chill* and *Damp* which attended the Darkness of this Eclipse, of which most Spectators were sensible, and equally Judges. (Halley 1715: 261)

Oth is humans other than the author.

(9) **My worthy Colleague Dr. John Keill** by reason of Clouds saw nothing distinctly at *Oxford* but the End, which he observed at 10 h. 15'. 10". (Halley 1715: 253)

Meta is a reference to another part of the same document.

(10) **Hitherto** I exhibit only what my self saw [...]. (Halley 1715: 251)

Inter is a reference to a document other than the one in hand.

(11) **What we have received from other places** is as follows [...]. (Halley 1715: 252)

Exist is an existential marker functioning as theme.

(12) and **there** was very little, or no Wind [...]. (Halley 1715: 252)

Ment is reference to a mental process or argumentation.

(13) **Having computed that the Eclipse would begin at 8 h. 7'**, I attended soon after Eight with a very good Telescope of about Six Foot, without stirring my Eye from that part of the Sun whereat the Eclipse was to begin: [...]. (Halley 1715: 247)

Time is a temporal reference.

(14) **At 7 h. 45'. 48".** it was 61°. 34'. 40". (Halley 1715: 247)

Math is a mathematical expression or a reference to mathematical calculation. There are no examples of this in the English text.

(15) **la moitié qui est 1° 30' ajoutée au 18° 25' de la Vierge, lieu où se trouveoit Saturne le 12 Juillet**, donnera l'intersection de l'anneau avec l'Orbite au 19° 55' du même signe [half, which is 1° 30', added to the 18° 25' of Virgo, the place where Saturn is on 12 July, will give the intersection of the ring with the orbit at 19° 55' of the same sign]. (Maraldi 1715: 18, translation added)

Sit is a spatial reference.

(16) and *Whitley being by Ogilvy's Mensurations, 118 measured Miles from London*, it is plain that the Centre past over Islip, which is, by the same Admeasurement, 57 such Miles on that Road, and about five Miles almost due North from *Oxford*: [...]. (Halley 1715: 255)

The incidence of the various types of theme in the two documents is shown in Table 5.

**Table 5:** Theme in the two documents.

Theme	<i>Philosophical Transactions</i>	<i>Mémoires</i>
Obj	45 (29.03 %)	56 (47.06 %)
Obs	6 (3.87 %)	13 (10.93 %)
Auth	11 (7.10 %)	11 (9.24 %)
Oth	14 (9.03 %)	3 (2.52 %)
Meta	1 (0.64 %)	—
Inter	3 (1.94 %)	—
Exist	3 (1.94 %)	2 (1.68 %)
Ment	31 (20.00 %)	19 (15.97 %)
Time	34 (21.93 %)	12 (10.08 %)
Math	—	3 (2.52 %)
Sit	7 (4.52 %)	—
<b>Total</b>	<b>155 (100 %)</b>	<b>119 (100 %)</b>

While the analysis of process types showed little difference between the French and English documents, this analysis of themes shows several considerable differences. The object of study provides the highest proportion of themes in both texts, but this is considerably more so in the *Mémoires*, where it accounts for 47.06 % of the themes, than in the *Philosophical Transactions*, where the figure is 29.03 %. Hence the thematic highlighting of the object of study is much greater in Maraldi's text than in Halley's. The second most common type of theme in the English text is time, accounting for 21.93 % of the themes. This is highly unusual in this genre where time is normally relatively rare as a type of theme (Banks 2008, 2017b). The thematic highlighting of time in this text is an indication of the degree to which Halley attaches importance to this feature. For him, the precise times at which the various phenomena occurred is of crucial importance. In contrast, in *Mémoires*, time is only the fourth most common type of theme, accounting for 10.08 % of the themes. This is still a relatively high proportion, though nothing like the 21.93 % found in the English text. So the timing of phenomena has much less thematic importance in the French text than in the English. The third most common type of theme in the English text is mental, accounting for 20 % of the

themes. In the French text this category accounts for 15.97 % of the themes, but although this is a lower percentage than in the English text, it is nevertheless the second most common type in the French text. The third most common type in the French text is observation, accounting for 10.93 % of the themes. This type accounts for only 3.87 % in the English text, showing that the act of observation is considerably more thematically important in the French text than in the English.

Hence, from a thematic point of view, in the French text the object of study and the fact of observation are considerably more important than in the English text, while in the English text temporal marking is more important than in the French. The same might be said of mental features, but this must be tempered by the fact that this type of theme is nevertheless the second most common in the French text, and the difference is rather less, at only 4.03 percentage points.

It might also be noted in passing that while the two texts have virtually the same number of finite verbs, the number of themes (and therefore of ranking clauses) is considerably different. The average number of finite verbs per ranking clause is 2.5 in the *Philosophical Transactions*, but 3.3 in the *Mémoires*. This probably indicates that the French text is more syntactically complex than its English counterpart.

This leads to the conjecture that the grammatical form of themes may contribute to the complexity of the syntactic structure. This is the subject I will now turn to.

## 5 Theme: grammatical function

Themes can take a number of grammatical functions; they may function as subject.

(17) **This moment** was determinable with great nicety, the Sun's light being extinguish'd at once; [...]. (Halley 1715: 247)

Themes can also function as circumstantial adjunct, and they can appear in a number of grammatical guises. They may be adverbs.

(18) **Hitherto** I exhibit only what my self saw, but there were with us a great many of the Members of the Society; [...]. (Halley 1715: 251)

They can also be prepositional phrases.

(19) **From these Data** we may securely determine the Remainder of this Track, and that the Edge of the Shadow having past over the rest of *Yorkshire* went off to sea about *Flamborough* head. (Halley 1715: 258)

Clauses can also function as adjunct themes, and these can be either finite or non-finite.

- (20) But **when he is near the Horizon**, it will be necessary to have regard to the true Figure, by reason of the great Length to which the Transverse Axe is extended, and particularly when the Shade is entering upon or leaving the Earth's Disk. (Halley 1715: 259)
- (21) **The Day of the Eclipse approaching**, I received the Orders of the Society to provide for the Observation to be made at their House in *Crane-Court*, [...]. (Halley 1715: 246)

Nominal groups can also function as adjunct themes.

- (22) **The next Day April 12°**, just before the Eclipse began, we took three Distances from the Zenith, *viz.* at 7 h. 424. 52". (Halley 1715: 246)

Where an extraposed structure, sometimes called thematized comment (Thompson 2004) occurs, the extraposition matrix may function as theme.

- (23) [...] and **it shall suffice to say**, that the Shadow came out of the Atlantick Ocean, having past over the Island Azores; [...]. (Halley 1715: 258)

Cleft items can also function as theme. There are no examples of this in the English text.

- (24) **c'est la surface Meridionale** qui a été éclairée jusqu'à ce temps-là [It is the southern area which was illuminated until that moment]; [...]. (Maraldi 1715: 22, translation added)

Complements functioning as theme are rare. There is a single example in this sample.

- (25) [...] and yet **more so** was that of the Emersion, for the Sun came out in an instant with so much Lustre that it surprised the Beholders, and in a moment restored the Day, *viz.* at 9 h; 12'. 26". true time, after he had been totally obscured for 3', 23" of Time [...]. (Halley 1715: 247)

Predicators can function as theme, notably in imperative clauses, but there are no examples of this in either of the texts under study.

The distributions of the various grammatical forms of themes is given in Table 6.

In present-day English (and French), it would generally be accepted that in declarative clauses the unmarked theme choice would be subject. Adjunct themes would also be fairly common. Complements acting as theme would be rare in English and virtually non-existent in French (Banks 2017c), and predators even rarer, though they would be usual in imperative clauses (of which there are none in this sample) (Banks 2019; Fontaine 2013; Halliday and Matthiessen 2014; Thompson 2004). It is therefore surprising to see that in Halley's text it is circumstantial adjuncts which constitute by far the largest group of themes, accounting for 56.13 %. Subjects

**Table 6:** Distributions of the various grammatical forms of theme.

	<i>Philosophical Transactions</i>	<i>Mémoires</i>
Subject	60 (38.70 %)	67 (56.30 %)
Adjunct	87 (56.13 %)	41 (34.45 %)
Adverb	5 (3.23 %)	—
Prep phrase	51 (32.90 %)	19 (15.97 %)
Finite clause	15 (9.68 %)	9 (7.56 %)
Non-finite clause	13 (8.39 %)	8 (6.72 %)
Nominal group	3 (1.93 %)	5 (4.20 %)
Extraposition matrix	7 (4.52 %)	6 (5.04 %)
Cleft	—	5 (4.20 %)
Complement	1 (0.65 %)	—
<b>Total</b>	<b>155 (100 %)</b>	<b>119 (100 %)</b>

functioning as theme account for 38.70 % of the themes. Among the adjunct forms, prepositional phrases constitute the largest group, accounting for 32.90 % of all themes, but one might also notice the relatively high proportion of clausal types, 9.68 % finite clause and 8.39 % non-finite. In contrast, the distribution in Maraldi's text is somewhat closer to the present-day norm, virtually reversing the proportions found in the English text, with 56.30 % of the themes functioning as subject, and 34.45 % as adjunct. Adjuncts in the form of prepositional phrases account for 15.97 % of all themes, but clausal types again account for a relatively large percentage, 7.56 % finite and 6.72 % non-finite.

This analysis brings out the extent to which Halley is at pains to highlight the circumstances of the phenomena he is studying. To some extent the circumstances seem to take precedence over the object of study. It is almost as if the object of study is a given, taken for granted, so that the circumstances of the phenomena become the essential elements in the constitution of his picture of reality. This is not so in the French text, where the object of study remains the highlighted centre of attention. The relatively high incidence of clausal types of adjunct theme is an indicator of a certain degree of complexity in both texts, though this may be simply a reflection of the general style of this period.

## 6 Nominalized processes

The importance of nominalization in scientific writing has been pointed out, notably by Halliday (Halliday 1987, 1998; Halliday and Martin 1993). Among the effects of the nominalization of processes is the fact that this objectivizes the process, making it

something which is given, taken for granted, and hence frequently appropriate as a technical term. The incidence of the nominalization of processes, in terms of the process type they represent is shown in Table 7.

**Table 7:** Nominalization of processes in the two documents.

	<i>Philosophical Transactions</i>	<i>Mémoires</i>
Material	97 (58.43 %)	54 (44.63 %)
Mental	37 (22.30 %)	44 (36.36 %)
Relational	11 (6.63 %)	19 (15.70 %)
Verbal	18 (10.84 %)	—
Existential	3 (1.80 %)	4 (3.31 %)
<b>Total</b>	<b>166 (100 %)</b>	<b>121 (100 %)</b>

Halley uses nominalization rather more than Maraldi. In the English text they occur at the rate of one per 2.4 finite verbs, while in the French text they occur at the rate of one per 3.2 finite verbs. Material and mental processes taken together account for a large majority of the nominalized processes, 80.73 % in the English and 80.99 % in the French, but material processes account for a considerably higher percentage in the English than in the French text, while mental processes account for a considerably higher percentage in the French text than in the English. In the *Philosophical Transactions*, 58.43 % of the nominalized processes are material. Some terms, however, may occur a large number of times. This is notably the case of *eclipse*, which provides 35 tokens (36 % of the nominalized material processes). In Maraldi's text, there is no term which dominates the nominalized material processes in the way which *eclipse* does in the English text. The nominalized material process which occurs most frequently is *apparence*, with ten tokens (19 % of the nominalized material processes) followed by *mouvement*, eight tokens (15 %). The nominalized mental processes in Halley's text are dominated by the perception process *observation*, which occurs on 17 occasions (46 % of the nominalized mental processes). This is replicated in Maraldi's text where the French word *observation* provides 22 tokens (50 % of the nominalized mental processes). In the English text, other than the term *observation*, examples of nominalized mental process are almost invariably cognitive, mostly with a single token, and none occurring more than twice (*expectation*, *predication*, *judgement* ...). In the French text, again, other than *observation*, almost all examples of nominalized mental process are cognitive, with *détermination* providing eight tokens (15 % of the nominalized mental processes).

Hence, while physical events are the most commonly nominalized sort of process in both texts, this is much more so in Halley's text than in Maraldi's. On the other hand, mental processes are nominalized to a greater extent in the French text than in the English.

## 7 First person pronouns

The extent to which the scientific researcher is present in his text has been a frequent subject in recent years (e.g. Banks 2021a; Hyland 2001, 2002), particularly in view of the fact that throughout most of the 20th century it was thought that scientists avoided use of the first person pronoun. It is therefore of interest to see to what extent first person pronouns were used in the early eighteenth century.

In Halley's article, there are 34 examples of the first person pronoun, *I*, and 23 of the plural pronoun, *we*. The singular subject pronoun, *I*, thus occurs with 9 % of the finite verbs, and the plural pronoun, *we*, with 6 %, together accounting for 15 % of the finite verbs. In addition to these subject pronouns, there are two examples of *me*, as complement or prepositional compleative, four of *us*, as complement or prepositional compleative, four of the possessive adjective, *our*, and three of the possessive adjective, *my*.

In Maraldi's article, there are 36 examples of the plural first person pronoun *nous* functioning as subject, and 26 of the impersonal pronoun, *on*, all of which are inclusive. There are no examples of the singular first person pronoun, *je*. Hence, *nous* functions as subject of 9 % of the finite verbs, and *on* of 7 %, together accounting for 16 % of finite verbs. In addition, there are 14 examples of *nous* functioning as complement, and 5 of the possessive adjectives *notre* and *nos*.

So, use of first person pronouns is mainly a case of subject pronouns, and these occur at almost the same rate in both texts. The process types of the verbs with which these occur are shown in Table 8.

**Table 8:** First person pronoun subjects in the two documents.

First person pronoun subjects	<i>Philosophical Transactions</i>			<i>Mémoires</i>		
	<i>I</i>	<i>We</i>	<i>Overall</i>	<i>Nous</i>	<i>On</i>	<i>Overall</i>
Material process	6 (17.65 %)	6 (26.09 %)	12 (21.05 %)	1 (2.78 %)	—	1 (1.61 %)
Mental process	24 (70.59 %)	14 (60.87 %)	38 (66.67 %)	28 (77.77 %)	24 (92.30 %)	52 (83.87 %)
Relational process	—	1 (4.34 %)	1 (1.75 %)	2 (5.56 %)	1 (3.85 %)	6 (9.68 %)
Verbal process	4 (11.76 %)	2 (8.70 %)	6 (10.53 %)	5 (13.89 %)	1 (3.85 %)	3 (4.84 %)
<b>Total</b>	34 (100 %)	23 (100 %)	57 (100 %)	36 (100 %)	26 (100 %)	62 (100 %)

In present-day English scientific articles there is some evidence that where first person pronoun subjects occur, about three-quarters do so with mental process verbs (Banks 2021a, 2021b). It is interesting to see that the situation was fairly similar in the early eighteenth century. In the English sample, roughly two-thirds of the first person pronoun subjects occur with mental process verbs, 70.59 % in the case of the singular pronoun, and 60.87 % in the case of the plural. In the French sample, the rates are even higher: 77.77 % in the case of *nous*, and *on* occurs almost exclusively with mental process verbs, since this is the case of 24 of the 26 cases (92.30 %) which are found. In contrast, in the English sample, about a fifth of the first person pronoun subjects occur with material process verbs, 17.65 % in the case of *I*, and 26.09 % in the case of *we*. In the French text, on the other hand, first person pronoun subjects hardly ever occur with material process verbs: there is a single example with *nous*, and none at all with *on*.

So, the majority of first person pronoun subjects are used with mental process verbs in both texts, but this is even more the case in the French text than the English. In Halley's text two-thirds of the first person pronoun subjects occur with mental process verbs, while a fifth occur with material process verbs. In Maraldi's text, 83.87 % of the first person pronoun subjects occur with mental processes verbs, but hardly any with material process verbs. Hence while Halley's first person is presented as a person who, to a certain extent, carries out physical actions, this is not the case with Maraldi, whose first person is presented almost exclusively as a person involved in cerebral activity.

## 8 Conclusions

We have seen that in terms of process type there is little difference between the two texts. When we consider what themes refer to, however, we find that a considerably higher percentage of Maraldi's themes refer to the object of study and to observation, than is the case in Halley's text. On the other hand a considerably higher percentage of Halley's themes refer to time than is the case in Maraldi's text, and a slightly higher proportion refer to mental processes. In terms of the grammatical form of themes, Halley uses a much higher proportion of adjunct themes than Maraldi, who uses a higher proportion of subject themes than Halley. When it comes to nominalized processes, Halley uses a greater proportion of nominalized material processes than Maraldi, whereas Maraldi uses a greater proportion of nominalized mental processes than Halley. In both texts, a single nominalized mental process may provide a large number of tokens. In the case of nominalized material processes, this is true of Halley's text, but less so of Maraldi's. Where first person pronoun subjects are used by Halley, they occur readily with mental processes, and to a certain extent with

material processes; when used by Maraldi, they occur extensively with mental processes, but hardly ever with material processes.

The difference between these two texts are admittedly not enormous, but where they do exist, they would, in general, seem to indicate on the part of Halley, a desire to place his object of study in a circumstantial framework, particularly temporal, thus using his data to build up a detailed picture of the phenomenon he is studying. There is also a concentration on the material aspects of this phenomenon. Maraldi, on the other hand, concentrates on material features, but as the basis of a mental construct.

My conjecture is that these differences come about because of the differing philosophical stances of these two scientists. Halley's point of view, like all members of the Royal Society at that time, was based on his interpretation of Bacon. This stipulated that scientific activity must be based on observation and experiment, and that it was only on the basis of accumulated knowledge that theory could be established. In other words it was an inductive method (Jalobeanu 2015; Malherbe 1996). This is consistent with his building up of material details of the object and the circumstantial factors surrounding it. The *Académie Royal des Sciences*, of which Maraldi was a member, was, on the other hand dominated by the thought of Descartes, who believed that the evidence of our senses is suspect, hence his celebrated *tabula rasa*. This means that theory building is primary, and observed fact is secondary to mental activity (Anstey and Vanzo 2023; Brockliss 1992). This is consistent with Maraldi's insistence on mental activity and his concentration on material factors as an object of a mental construct.

This paper has discussed differences found in two articles. It is therefore, in a sense no more than two case studies. It would consequently not be appropriate to extrapolate these results to other scientific texts of the same period. Further study, and analysis of other texts will be necessary before that is possible. At the same time, as I said earlier, there is no reason to believe that these texts are not representative. Whether they are or not remains a moot point.

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