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The simple present and the simple past in the scientific journal article: a diachronic perspective

David Banks

Corpus

- 1 This study¹ considers the uses of the simple present and simple past verb forms in the scientific journal article over a comparatively long period of time. It attempts to show how the changes in tense use correspond to changes in the scientific context. In order to do this, I shall use a small corpus which has been analysed manually. The corpus consists of a selection of articles from the *Philosophical Transactions* of the Royal Society, which was founded in 1665, and still exists, although since 1997 it no longer publishes primary research, this role having been transferred to another of the Royal Society's publications (Atkinson 1999). The corpus is made up of thirty articles; two were selected from the year 1700, and two at twenty-year intervals up to 1980. For each year in question, one of the articles is from the physical sciences (basically physics and chemistry), and one from the biological sciences (mainly biology and zoology but including medicine and palaeontology). The corpus thus constituted has a total of 126,555 words and 9,680 finite clauses. The use of tenses has previously been studied from a synchronic point of view (e.g., Malcolm 1987, Salager-Meyer 1992, Burrough-Boenisch 2003), but the few diachronic studies of scientific writing which exist (Bazerman 1988, Gross 1996, Gross et al. 2002, Atkinson 1999, Valle 1999) do not consider this question in any detail.
- 2 The general picture which emerges from study of this corpus is that in 1700 the physical sciences were already experimental, the intellectual revolution which had produced what was then known as the “experimental philosophy” having taken place in the second half of the seventeenth century (Jones 1961). The biological sciences were, however, descriptive, and they were to remain so until the middle of the

nineteenth century, which thus constitutes a turning point. It is only from the middle of the nineteenth century onwards that the biological sciences begin to be experimental, and from that date experimental and descriptive articles continue side by side. A second turning point occurs at the beginning of the twentieth century, when, in the physical sciences, mathematical modelling takes on particular significance. In the course of the twentieth century mathematical calculation and the modelling of physical phenomena are frequently as important as the experiment itself.

- 3 The theoretical background to the study presented here is that of Systemic Functional Linguistics (Halliday & Matthiessen 2004, Banks 2005), but I hope that it is written in such a way that it will be easily comprehensible to those less familiar with that theoretical approach.

General Results

- 4 Table 1 gives the percentages of simple present and simple past forms as a percentage of the total number of finite verb forms for each of the articles in the corpus. The percentage includes both active and passive voice. Thus for the 1700 article in the physical sciences 74% of the finite verbs are simple present, and 12% are simple past. The remaining 14% are made up of verb forms including aspect markers (progressive or perfective) or modal auxiliaries.

Table 1. Percentages of verbs in the simple present and simple past

	Physical Sciences			Biological Sciences	
	Present	Past		Present	Past
1700	74	12		12	81
1720	21	72		67	6
1740	53	4		57	20
1760	42	37		74	8
1780	62	14		64	20
1800	26	52		70	11
1820	53	29		30	46
1840	28	44		64	13
1860	40	39		64	13
1880	56	25		21	62
1900	63	18		36	43
1920	56	28		72	11
1940	60	18		73	6
1960	75	1		56	25
1980	58	23		58	22

- 5 These figures show that the present is more frequent than the past in 12 out of 15 physical articles and in 11 out of 15 biological articles. Otherwise the figures seem to be fairly variable, although it is possible to see some stabilization from 1880 onwards in the physical articles, and from 1920 onwards in the biological articles. From those dates the use of the present tense ranges from 55% to 75%, whereas it had previously varied from 21% to 74% for the physical articles, and 12% to 74% for the biological articles. From those same dates, the past is always used with a frequency of less than 30%, whereas for the physical articles it had previously ranged from 4% to 72%, and for the biological articles from 6% to 81%.

- 6 I will now consider the functions for which these two verbs forms are used.

Description of an experiment

- 7 Experiments are usually described in narrative form, and this leads to the use of the past. Since the physical articles were experimental from the very beginning of this period, the corpus supplies examples of this from 1720 to 1980.

1....I **took** the Flasks out of the hot Water, and pouring that which **held** the Water into a Cylandrick Vessel that **had** three Pints of cold Water in it, I **did** at the same time **plunge** the Flask with *Mercury* into another Cylandrick Vessel containing also three Pints of cold Water, and **observ'd** which of the cold Waters **was** most **heated** in the following manner. (Desaguliers 1720)²

2. Experimental pumping **was repeated** to determine an optimum pumping rate. In one experiment, a sample of fluorescent CaWO_4 , powdered finer than $2\ \mu\text{m}$, **was placed** on top of the lunar simulant material to see if the selected pumping rate **caused** any significant diffusion of the material. A methyl cellulose millipore filter with a pore size of $0.22\ \mu\text{m}$ **was placed** on the downstream side of the screen, and, after the experiment, **examined** by electron microscope to detect any CaWO_4 particles. (Horai 1980)

- 8 Since the biological sciences only became experimental at a much later date, there are no examples in the earlier articles, but this function of the past is to be found in the biological articles for 1820, 1860, 1900, 1920, and 1980.

3. In the spring of 1817, two oak trees, of nearly the same age, and growing contiguously in the same soil, **were selected** each being somewhat less than a century old. The one **was deprived** of its bark, to as great an extent as the inexperience of my workmen **permitted** me to have done without danger to them, and it **was** then **suffered** to remain standing. The other tree **was felled**, and, in the usual manner, immediately **stript** of its bark; and the trunk **was** then **removed** to a situation in which it **was** securely **protected** from the sun and rain. (Knight 1820)

4. For studies of the cuticle structure, fragments of exoskeleton **were removed** both from intaglios and from exuviae, broken cleanly across to give transverse sections. These **were etched** in saturated solutions of EDTA (disodium salt) before mounting for scanning electron microscopy (s.e.m.). Etching **was controlled** by observation under a high power binocular microscope. Etch times **varied** between 5 and 35 min. Fragments of visual surface from post-ecdysial eyes **were** similarly **treated**, but in one the cuticle **was** entirely **dissolved** away and the internal mould **examined** (figures 46, 47). Whole eyes **were removed** from intermoult specimens. They **were** then **trimmed** into small blocks with a diamond blade of 1 cm. radius. (Miller 1980)

- 9 Knight's 1820 article is historically interesting in that it is the earliest experimental article in the biological sector, although it will be noted that this experiment is not in a laboratory situation.
- 10 There are however two ways of presenting the experiment other than as a narrative. The first of these is to present it as a general process, that is, one which is in general practice, or which has at least been repeated on a number of occasions. In this case it is the present which is used. It is not the simple fact of repetition that leads to this function, as can be seen from example 2 above. It is rather the fact that the experiment is presented as something repeated and hence, presumably, repeatable. In the physical sciences, examples of this occur throughout the period considered, though they seem to disappear in the twentieth century, where the only example after 1900 occurs in the 1980 article.

5. If, on the other hand, the three last experiments **are made** with the *minus*, instead of the *plus* electricity, the appearances, and consequently the reasoning upon them, **are inverted**: for the *plus* appearance in that case, must be owing to the tendency of the fluid from the earth, air, and other neighbouring bodies, towards the opposite side of the glass, where the *power acts*, which **causes** the *minus* appearance. (Wilson 1760)
6. If a small quantity of a gas, A, **is mixed** with another gas, B, and the mixture **passed** along a tube, the sides of which completely **absorb** A, to find what quantity of A **emerges** from the tube with B. (Townsend 1900)
- 11 Here, the if-clause is used as a way of generalizing the process described. This strategy of presenting the experiment as a general process is much less frequent in the biological articles, although there are occasional examples.
7. For the preparation of this substance the original resin **is coarsely powdered** and **extracted** with cold alcohol, in order to remove, as far as possible, the syncoretin. The undissolved residue **is then exhausted** with boiling alcohol. The several solutions thus obtained **are filtered** and **allowed** to cool, when a white deposit **is formed**, which generally **shows** but little indication of crystalization. (De la Rue 1860)
- 12 The second way in which the experiment can be presented other than as a narrative, is that of presenting it as a recipe. Once again, this leads to the use of the present rather than the past. This strategy tends to be used for experiments of a researcher other than the author himself. It is usually introduced in the context of a narrative in the past, with a switch to the present for the description of the experiment itself in the form of a recipe. Although the strategy is not frequent, it occurs spasmodically in the physical articles from 1760 to 1900, and in the biological articles from 1860 to 1900.
8. PROFESSOR LICHTENBERG, of Gottingen, some time ago **made** an experiment upon the electrophorus, an account of which **was first received** in London towards the latter end of the year 1777. [...] In brief, the experiment **is** as follows:
The electrophorus, that **is**, a plate of some resinous substance, as sulphur, rosen, gum-lac, &c. **is first excited**, either by rubbing, or otherwise; then a piece of metal of any shape at pleasure, as, for instance, a three-legged compass, a piece of brass tube, or the like, **is set** upon the electrophorus; and to this piece of metal, so placed, a spark **is given** of the electricity contrary to that of the plate. (Cavallo 1780)
9. The method of the experiments, as suggested by Professor STOKES (British Association Report, 1862), **is** as follows: A prism **is cut** from a piece of spar, and the position of its faces with reference to the cleavage faces carefully **determined**. The prism **is mounted** on a spectrometer, and the collimator **adjusted** so that the rays of a definite wave length falling on the prism **are** parallel, the edge of the prism being parallel to the axis of revolution of the reading telescope. (Glazebrook 1880)
- 13 The use of the phrase **is** as follows here introduces the recipe format. Although this strategy is most frequently used for other researchers, this is not invariably the case.
10. When working with the first form of apparatus the experiments **were conducted** in the following manner: - The tube A **is raised** to a potential of 80 volts positive, and the quadrants to which the electrode **is joined are insulated**. The stream of air from the gasometer **is thus allowed** to pass through the apparatus, and, when the velocity **is** steady, the coil working the bulb **is turned** on for a fixed time (20 seconds generally) and a deflection of n_1 divisions **is obtained** on the electrometer scale. (Townsend 1900)
- 14 These two strategies, expressing the experiment as a general process or as a recipe, are rare in the twentieth century with a single example in 1980 appearing in the sample.

- 15 It is interesting to note the points at which authors switch from one of these verb forms to the other in the course of describing an experiment. Thus, in example 11, Davy, in 1820, switches from the past to the present; this occurs at a point where he moves from the action of the experiment itself, expressed in the past, to the features of the products involved, expressed in the present.

11. In the course of my experiments to ascertain the composition of fulminating platinum, I **treated** it with nitrous acid, and thus **procured**, as I have elsewhere stated, a grey oxide of platinum, which has not yet been described. It may be obtained by adding strong nitrous acid to fulminating platinum, boiling it to dryness, and exposing the dry mass to a heat just below redness, so as to expel all the nitrous acid. The oxide of platinum **remains**. It **is** to be finely pulverized and boiled, first in pure water, and then in a weak solution of caustic alkali to separate to last portions of acid, which **adhere** with great tenacity to it. It **is** now to be well washed and dried at a heat not exceeding that of boiling mercury. (Davy 1820)

- 16 Later in the same article, Davy travels in the opposite direction, changing from the present to the past; here, the more general statements introduced by the if-clause, in the present, are followed by more specific statements, in the past.

12. If the oxide **is mixed** with powdered glass and fused, a glass **is obtained** of a dull brown colour. The oxide **is** readily **reduced** by moistening it with oil of turpentine, and heating it moderately; or by exposing it to a dull red heat in the atmosphere; but it **requires** a strong red heat to reduce it in close vessels. Some of the oxide which had been well dried, first on a hot sand bath, and then exposed to a heat just below redness, on a slip of platinum, **was decomposed** in very small green glass retorts, over mercury. In two experiments in which I **used** 7 grains of the oxide, I **obtained** in each instance 6 grains of platinum, and 2.1 cubic inches of oxygen, the thermometer being at 60° and barometer 30°. I **found** also in the necks of the retorts, a slight trace of a fluid that **reddened** litmus paper, and had an odour similar to that of nitrous acid. (Davy 1820)

- 17 In Townsend's 1900 article the specific experiment is narrated in the past, but a when-clause introduces more general statements in the present. In this example, the passage between the two is somewhat eased by the presence of a form with progressive aspect, which perhaps might be seen as triggering the following simple present forms.

13. In order to obtain a uniform stream of air, the tube, G, **was connected** to a gasometer, and the velocity of the gas along the tubes, T, could be calculated by observing the rate at which the cylinder of the gasometer **fell**. When the bulb is giving out rays, the gas, as it **passes** the aluminium window, becomes a conductor, and the ions **are carried** with the stream into the tubes T₁. In passing through these tubes some of the ions **are discharged** by the sides, and the rest on coming into the field of force (caused by the difference of potential of 80 volts between the electrode and the tube C) **are removed** from the gas. (Townsend 1900)

- 18 Dawson, also writing in 1900, is another writer who passes from past to present to show a passage from specific to more general points.

14. It **seemed** at first possible that excessive swelling by Eau de Javelle might have caused this apparent bursting of the filaments, but the study of sections mounted in pure water and of hardened material **showed** the phenomenon to be quite normal. In sections of older tubercles the thicker filaments crossing the cortex **are** no longer to be seen, but those in the main tissue of the tubercles **persist** until decay has set in. (Dawson 1900)

- 19 The beginning of a results and discussion section is perhaps a precise example of the move from specific to general, and perhaps an attempt on the author's part to give

general validity to his results. Desaguliers, in 1720, provides an early example of this, though one can note the new paragraph at the point at which the verb form changes.

15. The Thermometer being again put into the first vessel **fell** 4 degrees, and afterwards again into the last it **rose** almost 3 degrees.

This **shews** that more heat **is communicated** by warm *Mercury*, than by an equal Bulk of Water equally warm'd; and therefore that there **is** more matter in the *Mercury*; but how much more matter there **is** in the *Mercury* **is not determin'd** by this Experiment alone. (Desaguliers 1720)

- 20 Wilson, in 1760, passes from present to past, and back to present again, in a very short space of time, showing that specific and generic functions can dovetail, and an author can pass back and forth between the two.

16. It **is** to be observed here, that the plus appearance in the poker **was caused** by that portion of the fluid; which **was driven** off from the outside of the bottle, by the repulsive force of the fluid conveyed into the bottle. And this **confirms** the reasoning upon the remarkable experiments related in the treatise published by Dr. Hoadly and myself. (Wilson 1760)

- 21 Duffield, in 1920, is peculiar, in that his switch from past to present occurs in mid-sentence, a triumph of function and semantics over form!

17. A light paper vane **was pivotted** upon a vertical axis 60 cm. above a horizontal arc, so that the rising convection currents **caused** it to turn, the number of revolutions of the vane in 1 minute providing a measure of their velocity. Arcs of constant length and varying current **were employed** and the mean curve C in fig. 21 **was obtained** as the result of a number of experiments, whence it **is** clear that over the range 2 to 10 ampères there **is** an increase in the velocity of the convection currents. For a given curvature of pole the suction upon it **is** proportional to the square of the velocity of the air moving past it, the curve D has therefore been drawn with ordinates proportional to the square of those of curve C, but on a different scale, it **represents**, therefore, the pressure effect of the convection currents. (Duffield 1920)

Description of equipment

- 22 The second major function which needs to be considered is that of the description of equipment. Here the date of 1900 seems to mark a watershed. From 1900 onwards equipment is usually described using the past, so that what is presented is a narrative of the construction of the experiment.

18. The movable parts of the apparatus **were** completely **enclosed** in a box, B, with a glass top to prevent disturbance from air currents in the room, and appropriate windows and holes **were made** in it to enable observations to be made. The torsion fibre **was enclosed** in a vertical tube. A lens **focussed** an image of the arc upon a screen to facilitate the measurement of the arc-length. (Duffield 1920)

- 23 However, although this is usual in the twentieth century there are occasional counterexamples.³

19. A rectangular parallelepiped piece of copper, 1.2 mm x 3.5 mm x 9 mm, with a hole containing the thermocouple junction drilled on one of the two end surfaces, **is embedded** into a groove, 1.2 mm deep and 3.5 mm wide, cut on the inner surface of the heater along its length, and tightened to the heater by a stainless steel screw. As the thermocouple junction **is** thus **connected** to the heater by thermally conductive metals, the junction **remains** isothermal to the heater's inner surface. (Horai 1980)

- 24 Before 1900 it is usually the present that is used, and this is frequently associated with an intertextual reference, as in the reference to “fig. 1” in this comparatively early, 1780, example.

20. The principal part of this instrument **is** a glass tube CDMN, cemented at the bottom into the wooden piece AB, by which part the instrument **is** to be held when used for the atmosphere, and it also **serves** to screw the instrument into its wooden case ABO, fig. 1 when it **is** not to be used. The upper part of the tube CDMN **is shaped** tapering to a smaller extremity, which **is** entirely **covered** with sealing wax melted by heat, and not dissolved in spirits. (Cavallo 1780)

- 25 Any corpus of natural language texts will throw up its quota of curious examples. The following example is one such, where the description of the equipment, which begins, as one would expect for a 1980 article, in the past, switches to the present.

21. Six thermocouples, labelled respectively L_1 , L_2 , M_1 , M_2 , U_1 and U_2 , **were attached** to the core tube, the lowest, L_1 , 11.43 cm from the lower end of the core tube while the others **were separated** by 3.81 cm. Four thermocouples O_1 , O_2 , O_3 , and O_4 , **are attached** to the heater at 5.08, 7.62, 10.16 and 15.24 cm respectively from the upper end of the heater (**see** figure 6). As the heater is 20.32 cm long, thermocouple O_3 **is** equidistant from the upper and lower ends of the heater. To determine the thermal conductivity at one of the core-tube's thermocouple positions, the heater position **is adjusted** so that thermocouple O_3 **is** at the same level as the core-tube's thermocouple at which the thermal conductivity **is** to be determined. (Horai 1980)

- 26 One might speculate that there is a change from constructive to descriptive mode, but the parallelism of the phrases “six thermocouples ... were attached” and “four thermocouples ... are attached” militate against this *ad hoc* explanation. One might again speculate that the intratextual reference, “see figure 6”, triggers the change, but this seems insufficient to warrant the change involved. Perhaps it must just be accepted that natural language will provide some examples which, individually, resist attempts at explanation.

Description of phenomena

- 27 In the biological sciences, the observation and description of phenomena might be considered the biological equivalent of the experiment in the physical sciences. This concerns notably fauna and flora in biology, but also the description of fossilized remains, for example in palaeontology. The commonest form used throughout the period is the past, the observation and description being presented as a narrative.

22. In this process the tail, which **was** similar to that of a cock, first **appeared** after moulting. In the following year, she **moulted** again, and **produced** the same features. In the third year she **did** the same: at the same time she **had** spurs similar to those of a cock. She **died** in the following winter during the hard frost, namely, in the winter 1775/6. She never **bred** after this change in her plumage. (Hunter 1780)

23. The remaining 356 specimens, which **showed** no distortion, **were** by no means perfect. Of these, 186 **were fractured** or badly **weathered**. In many cases the fracture **involved** loss of a character, and so the specimen **had** to be rejected, while in other cases the specimen could be used. (Joysey 1960)

- 28 However, less frequently, but also throughout the period, there are examples of observation and description presented as general statement.

24. The cavity of the mouth **is situated** as in other quadrupeds, and **has** two grinding teeth on each side, both in the upper and lower jaw; but, instead of incisor

teeth, the nasal and palate bones **are continued** forwards, lengthening the anterior nostrils, and forming the upper part of the beak; and the two portions of the lower jaw, instead of terminating at the symphysis, where they **join, become** two thin plates and **are continued** forwards forming the under portion of the beak. (Home 1800)

25. Beneath the epicuticle **is** a prismatic layer of typical trilobite type and of normal thickness (10 μm) for *P. rana milleri*. The large calcite crystallites **are arranged** with their *e*-axes normal to the surface, and the surface **shows** an even and regular crystal texture (figure 13). (Miller 1980)

Presentation of results

- 29 Among those functions which are perhaps not major, but still fairly significant, one might class the presentation of results. This is frequently associated with discussion of the results, and is usually expressed in the present. This is probably an attempt to give permanent validity to the results presented.

26. The four last experiments **prove**, that the maximum of the heating power **is vested** among the invisible rays; and **is** probably not less than half an inch beyond the last visible ones, when projected in the manner before mentioned. The same experiments also **shew**, that the sun's invisible rays, in their less refrangible state, and considerably beyond the maximum, still **exert** a heating power fully equal to that of red-coloured light; and that, consequently, if we may infer the quantity of the efficient from the effect produced, the invisible rays of the sun probably far **exceed** the visible ones in number. (Herschel 1800)

27. It **is** clear that the balance of evidence **favours** the conclusion that the particles responsible for the recoil **are** electrons. It **is** doubtful if we can press our results much further than this in view of the very small forces to be measured and the complex conditions under which experiments of this nature must be conducted, but the view of the mechanism of the arc which **is** most **favoured** by this research (indeed the agreement with it **is** remarkable, though it may be accidental) **is** that an oxygen atom arrives at the cathode with two positive charges of electronic magnitude, and that uncharged CO **is formed** which **removes** two of the four electrons, which we have already shown to be associated with the departure of each carbon atom from this pole, and which **are derived** ultimately from the source of current supply. (Duffield 1920)

Intratextual references

- 30 Intratextual and metatextual references are invariably in the present. This includes references to other parts of the article as well as to tables and figures in the article. This is one of the rare features to which I have found no counterexamples. However these intratextual references hardly ever occur before 1840. The one mentioned above, in example 20, being a rare early example.

28. The apparatus when in action **is represented** by fig. 3, and may be described as follows. A **represents** the iron wires forming the electro-magnet when the voltaic current **is passed** through the primary coil; C, C the secondary coil; D the bar of soft iron; e, e cups of mercury connected with the primary coil; F, F binding screws to connect the primary coil with the voltaic battery; G, G binding screws attached to the ends of the secondary wire. (Gassiot 1840)

29. Figure 3 **illustrates** the experimental arrangement for the measurements of Apollo 15 type drill samples. The sample's core tube **is** 42.54 cm long, 2.04 cm in inner diameter and 2.33 cm outer diameter. The heater **is** a hollow circular

cylinder, concentric to the core-tube, 30.23 cm long with inner and outer diameters of 3.56 cm and 4.92 cm respectively. (Horai 1980)

Intertextual references

- 31 References to other work, including citations and quotations provide a good deal of variation. The most typical case is where both the verbal process verb, and the contents cited are in the present.

30. Mr. Hamilton **apprehends**, that the electric particles, by their elastic force, **issue** directly forwards from the points, and **endeavour** to expand themselves; but meeting with some resistance from the air, **force** the wire to move backward in a contrary direction, much in the same manner that a Catherine-wheel **is made** to turn round in a direction, contrary to that in which small rockets affixed to its periphery **discharge** themselves. (Wilson 1760)

31. R. WAGNER **mentions** that in blood taken from the heart of some of the invertebrata – *Unio* and *Anodonta* – when the coagulating fibrin **makes** its appearance, blood-corpuscles **are seen** – *often grouped necklace-like* – around it. (Barry 1840)

- 32 Where the verbal process verb is in the present perfect or in nominalized form, the same strategy is followed with the contents of the previous work expressed in the present.

- 33 There are a few cases, but this is fairly rare, of a verbal process verb in the present, but with the contents of the work cited in the past.

32. The Abbé, in particular, who has taken remarkable pains to find out from whence this uncertainty **arises**, **acquaints** us, in the *thirteenth letter*, with his difficulties, and how much it **perplexed** him to see, within an hour, in the same place, and with the same instruments, the effects changed, and become altogether contrary to those he had before observed. (Wilson 1760)

33. VALENTIN, however, **states** that the globules in question **entered** into the formation of the "uniting mucous tissue." (Barry 1840)

- 34 There are also some cases of verbal process verbs in the past, but these never occur, in the corpus, earlier than 1900, so this appears to be a twentieth century phenomenon. When this occurs, the contents is usually presented in the present.

34. From characters possessed in common by this mykoplasm and the infection tubes and filaments, FRANK concluded that they are of like origin, and are, in fact, formed by the plant itself as a means by which it conducts to the inner cells the symbiotic organisms (minute cocci) which are destined to grow there. (Dawson 1900)

35. Kahn gave equations representing the conservation of mass, momentum and energy across the ionization front and showed that there is a close analogy between combustion waves and ionization fronts. (Axford 1960)

- 35 Dawson, writing in 1900, provides a peculiar case. She includes an extremely extensive literature review, and there are numerous other references throughout her article. In these she uses all the combinations of present and past possible, even passing from one to the other as in the following example.

36. He **considers** the tubercles developed in these two genera to be typical of the two classes found in all the Leguminosæ, and **describes** in detail their respective relations to the vascular bundles of the roots, and the special characters of the inner "Bacteroid" tissue, noting in particular the absence of filaments along with Bacteroids in the cells of the tubercles of *Lupinus*. In accordance with BRUNCHORST, he **denied** the parasitic nature of the Bacteroids; indeed, he **considered** the

tubercles themselves to be merely storehouses of reserve material, chiefly albuminoids and possibly also starch. (Dawson 1900)

- 36 Although the “he” of “he considers” is coreferential with the “he” of “he denied”, there is a switch from present to past. One might hypothesize that it is the reference to Brunchorst that motivates this change.

Mathematics

- 37 Mathematical calculation and modelling play an important role, particularly in the physical sector, from the end of the nineteenth century onwards, with a rapid increase during the twentieth century. This introduction of mathematical discourse (O'Halloran 2005) generally uses the present, and accounts for an increase in the use of present forms in these articles.

37. The mean of the above determinations **gives** 93.08 at 18°.9 for the conducting power of pure copper. (Matthiessen 1860)

38. Important conclusions can be drawn from the graph of G against Y . This **is** a parabola which touches the lines $Y = 1$ and $G = 25/8$ as shown in figure 5, where there **is** also **drawn** the parabola $w(Y)$. Values of M_1 and M_2 and the corresponding signs of d and e **are** also **indicated**. The curve $G(Y)$ **is** closely **related** to the Rayleigh line in the theory of one dimensional flow with heat addition. (Axford 1960)

Minor functions

- 38 I would consider as minor functions the expression of more general narration, and historical passages on the one hand, and general statements on the other. As one would expect from more familiar (commonly called "general") genres, the first of these categories is expressed in the past.

39. Fifteen years ago, one *John Potin*, French-man, then Servant to my Lord *Culpepper*, **got** a fall, which **caused** him a heavy pain in the breast for a while. A month after, he being a shooting, a Musquet **did burst** in his hands, which **gave** so violent a recoyle against his Right side, that it **made** him spit blood immediately, and **continued** for six months. One year after he **began** to feel a pulsation on that side, and then he **spit** blood again, which **continued** ever since, but only in the Spring and the Fall. (Lafage 1700)

40. The correspondent's father, my friend Dr. BENNETT, F.L.S., being in London when these specimens had arrived, I **dissected** them in his presence, but **found** not any ovum in either uterus. The ovaria **showed** one or more enlarged ovisacs. (Owen 1880)

- 39 And the second is expressed in the present.

41. All the *Papavers* **are** Narcotick. The *Esulæ* and *Tithymali* **are** Cathartick; tho' both these **are** Lactescent, yet they **differ** from those which **are** Pappescent also. All the *Malva's* **are** chiefly Emollient; The Pentaphyllous kind astringent; as **are** also the Plantains. (Blair 1720)

42. In the majority of species which have been examined, pigmentation in any given part of a plant **is** due to one anthcyanin only. There **are**, however, a certain number of exceptions, in which a second constituent **is** present – usually in small proportion. (Lawrence 1940)

Closing remarks

- 40 There is evidently a wealth of information here, and I can do little more by way of conclusion than to summarize the main points.
- 41 Experiments are usually presented as narratives, and in this case they are expressed in the past. This occurs in the physical sciences throughout the period, and in the biological sciences from the mid-nineteenth century onwards. Exceptions occur when the experiment is expressed either as a general procedure, or as a recipe, the latter being usually the experiments of others; in these cases it is the present that is used.
- 42 The description of equipment is usually in the present, but past forms occur after 1900. The observation and description of phenomena, usually in the biological sciences, is expressed in the past.
- 43 Results and discussion are usually presented in the present. Intratextual references are invariably in the present. Intertextual references tend to use the present, but there is some variation, particularly after 1900.
- 44 Mathematical calculation and modelling, which play an important role in the physical sciences from the late nineteenth century onwards, are expressed in the present.
- 45 General narrative is, as one would expect, in the past, and statements of a general nature are, again as one would expect, in the present.
- 46 Finally, I would like to point out that in this study one can see these scientific authors using the resources of the language to make choices which depend on the changing historical and scientific context in which they found themselves. This study therefore provides a specific example of the way in which language is dependent on, and conditioned by, the context in which it is produced, and the fact that the context is essential for understanding language and the way it is used.
- Lafage 1700: This article is written in the third person, so it is not clear whether it was written by Lafage himself or by some other anonymous author.
- Desaguliers 1720: John Theophilus Desaguliers 1683-1744. Born in France, came to England at the age of eleven. Described by the *Encyclopaedia Britannica* as a “British inventor”.
- Cavallo 1780: Tiberius Cavallo, born Naples 1749, died London 1809. Came to England in 1771.
- Herschel 1800: Sir Frederick William (originally Friedrich Wilhelm) Herschel, born Hanover 1738, died Slough 1822. Came to England in 1757.
- Gassiot 1840: John Peter Gassiot 1797-1877.
- Matthiessen 1860: A. Matthiessen (co-author M. Holzmann).
- De La Rue 1860: Warren De La Rue, born Guernsey 1815, died London 1889 (co-author Hugo Müller).
- Horai 1980: K. Horai, one of six co-authors, the others being J.L. Winkler Jr., S.J. Keihm, M.G. Langseth, J.A. Fountain and E.A. West. All have institutional addresses in the USA.
- 47 Thus of thirty authors, three were born outside England (plus perhaps Matthiessen, for whom I have no information), but all were permanent immigrants to England, one of them from the age of eleven. This would seem to minimize any possible non-native speaker influence.

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APPENDIXES

Appendix 1. Corpus

Date	Article	Words	Finite verbs
1700	Poivy, Thomas: The Method, Manner and Order of the Transmutation of Copper in Brass	508	42
	Barjaze Mr.: An Account of an Extraordinary Pneusma of the Arteria Aorta near to the Basis of the Heart, with the Symptoms thereof	445	44
1720	Desaguliers, J.T.: An Account of an Experiment made on Thursday the last day of June, 1720 before the R. Society, to shew by a new vessel, that Bodies of the same bulk do not contain equal quantities of Matter, and therefore that there is an interspers'd Vacuum	324	29
	Baill, Patrice: A Discourse concerning a Method of discovering the Virtues of Plants by their external Situation	2,228	172
1740	Smith, Caleb: A new Method of improving and perfecting Catalogical Releases, by forming the Speculums of Glass instead of Paper	3,414	238
	Baker, Henry: The Discovery of a perfect plant in Samoe	1,504	134
1760	Wilson, Benjamin: Farther Experiments in Electricity	2,779	215
	Edwards, George: An Account of the Frog-fish of Surinam	1,127	91
1780	Cavallo, Tiberius: An Account of some new Experiments in Electricity with the Description and Use of two new Electrical Instruments	3,030	240
	Hunter, John: Account of an extraordinary Phœsant	1,778	161
1800	Herschel, William: Experiments on the Refrangibility of the invisible Rays of the Sun	2,054	165
	Horne, Edward: Some Observations on the Head of the <i>Osmotherychnus paradoxus</i>	1,240	116
1820	Davy, Edmund: On some combinations of Platinum	4,583	397
	Knight, Thomas Andrew: Upon the different qualities of the albumen of spring and winter-felled oak-trees	824	53
1840	Gaillard, John F.: An account of Experiments made with the view of ascertaining the possibility of obtaining a Spark before the Circuit of the Voltaic Battery is completed	4,654	332
	Berry, Martin: On the Coruscles of the Blood	5,320	423
1860	Mathiessen, A. & H. Holzmann: On the Effect of the presence of Metals and Metalloids upon the Electric Conducting power of Pure Copper	1,764	154
	De la Rue, Warren & Hugh Murray: On the Resin of <i>Ficus rubiginosa</i> , and a new homologue of Eucalypti-acid	6,383	536
1880	Gratebrook, R.T.: Double Refraction and Dispersion in Iceland Spar: an Experimental Investigation with a comparison with Wulff's construction for the Extraordinary Wave	3,067	355
	Owen, Prof.: On the Ova of the Echidna <i>Hypsignathus</i>	1,228	76
1900	Sammond, John S.: The Diffusion of Ions into Gases	10,125	867
	Dawson, Maria: "Nitragin" and the Nodules of Leguminosæ Plants	10,844	837
1920	Duffield, W.G., Thos. H. Burnham & A.H. Davis: The Pressure upon the Poles of the electric Arc	6,582	490
	Mummeley, J. Howard: The Epithelial Sheath of Hertwig in the Teeth of Man, with notes on the Follicle and Basomott's Membrane	5,764	437
1940	Hartree, D.R., W. Hartree & Bertha Swines: Self-consistent field, including exchange and superposition of configurations, with some results for oxygen	5,042	281
	Lawrence, William John Cooper, James Robert Price, Gertrude Maud Robinson & Robert Robinson	4,110	323
1960	Airford, W.I.: Ionization Fronts in Interstellar gas: the structure of ionization fronts	10,700	892
	Payne, K.A.: A study of variation and relative growth in the bladdod <i>Oxylentremes</i>	9,393	711
1980	Holte, K., J.L. Winkler Jr., S.J. Kelley, M.G. Langford, J.A. Fountain & S.A. West: Thermal conduction in a composite circular cylinder: a new technique for thermal conductivity measurements of lunar core samples	7,141	405
	Muller, J. & E.R.A. Clarkson: The post-ecdyasal development of the orifice and the eye of the Devonian trilobite <i>Rhacops rana</i> milleri Stewart 1927	6,590	464

NOTES

1. This paper is a rewritten version of a paper originally presented in French at the Nouvelles Journées de l'ERLA No.6, "Le temps dans le texte de spécialité", 18-19 Nov. 2005 at Brest, and published as Banks (2009) [NDLR]. This English version was presented at the 27^e Colloque du GERAS, "Cours et Corpus", 23-25 March 2006 at Lorient.
2. Highlighting of simple present and simple past forms in **bold** is mine throughout.
3. Some readers may wonder whether the possible presence of non-English speaking authors may affect the linguistic features used. To estimate any possible affect, notes on those authors whose names are not typically English are given below.

ABSTRACTS

The functions of the simple present and the simple past are considered in a corpus of English scientific journal articles selected from the *Philosophical Transactions of the Royal Society*, and covering the period 1700 – 1980. It is found that the past is used for experiments presented as narratives, but that other possibilities exist. The description of equipment is usually in the present, as are results and discussion. Intratextual references are always in the present but intertextual references are more complex. Mathematical sections, particularly important in twentieth century physics, are in the present. The uses of these verb forms mirror the changing context in which the texts were produced.

Le présent article étudie les fonctions du présent simple et du passé simple dans un corpus d'articles scientifiques en langue anglaise, tirés du *Philosophical Transactions of the Royal Society*. Le corpus recouvre la période 1700 – 1980. On constate que le passé s'utilise pour les expériences présentées comme des narrations, quoique d'autres possibilités existent. La description des expériences se fait au présent, ainsi que la présentation des résultats et leur discussion. Les références intratextuelles sont toujours formulées au présent, tandis que les références intertextuelles sont plus complexes. Les sections mathématiques, particulièrement importantes dans les sciences physiques au cours du vingtième siècle, utilisent le présent. L'usage de ces formes verbales reflète l'évolution du contexte d'où ces textes surgissent.

INDEX

Mots-clés: anglais scientifique, article de recherche scientifique, linguistique diachronique, passé simple, *Philosophical Transactions*, présent simple

Keywords: diachronic linguistics, *Philosophical Transactions*, scientific English, scientific journal article, simple past, simple present

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