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D'Alembert's Mathematical Correspondence: Beyond the Formal Description of Networks

Irène Passeron

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Abstract

D'Alembert (1717–1783) corresponded with some of the greatest mathematicians of his time, Leonhard Euler, Gabriel Cramer, and Joseph Louis Lagrange. This correspondence sheds light on the scientific controversies and epistemological issues of the day. It also clarifies the organization of the academic world in the middle of the eighteenth century, despite its lacks and losses. It allows us to determine the precise various statuses of a "letter," from the most public to the very private. We will question the relevance of a network epistolary representation, by inserting mathematical problems into the context of other forms of scientific communication: published treatises, academic reports, periodicals, and the *Encyclopédie* (1751–1772), the main medium for D'Alembert's work and for the Enlightenment. We will then focus on the relationships between Euler and D'Alembert, inserted into the overlapping of Paris-Berlin antagonisms and alliances.

Amongst the many different approaches that correspondences open us up to, two lines will be put forward here: to question the meaning that sets down a graphical representation of epistolary networks and, in parallel, to describe controversies by interweaving the various levels of interpretation suggested by the analyses of other written networks.

To speak of a network concerning mathematical correspondence may seem both trivial and inadequate: the triviality of a graphical representation of this

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correspondence as a mapping of geographical networks,[1] and the inadequacy between a focus on this mode of expression and the diversity of the modes of both exchanges and mathematical works.

By examining this tension, and by using the example of D'Alembert's correspondence, which is better known today,[2] we wish to clarify some of the parameters of the notion of network and draw attention to what can be done so that it no longer remains a static and inert material, but may, on the contrary, become a fertile ground for further research and readings.

For the last 30 years, perceptive studies carried out on scientific correspondence networks[3] have enabled us to clarify, in different times and places, the three functions of scientific correspondence: information (direct or indirect), legitimization of the respective positions of speakers, and mediation with third parties.[4]

Despite keeping it as a model, the notion of a "network" goes further than the simple graph of interconnections or even the structural frameworks of institutional links (for example, academic) and the local spheres of exchange (family or high society). Conversely, epistolary networks are often used to shed a contrasting light on other known records, both academic and literary.

We must therefore question the very nature of an epistolary relationship and the specific character of the semantic weight we attribute to it. Indeed, the notion of an "epistolary network" only makes sense if we are capable of identifying the parameters of the information, the impact, diffusion and variation of which we want to measure. Therefore, we must possess an accurate, up-to-date and reliable inventory and compare this network with other vectors of scientific exchange.[5]

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[1]The success of mapping correspondence lies in the fact that it provides a synthetic vision (on a map—modern or period, the correspondents being represented by localised dots and the letters by arrows) and, less often, a dynamic (in time), by placing these periodic exchanges within the context of other epistolary relations. It remains a challenge to map uncertainty and shortcomings.

[2]*D'Alembert. Œuvres complètes*, volume V/1, *Inventaire analytique de la correspondance*, Irène Passeron, in collaboration with Anne-Marie Chouillet and Jean-Daniel Candaux, 2009. Volume V/2, *Correspondance 1741–1752*, I. Passeron, in collaboration with Jean-Daniel Candaux, Alain Cernuschi, Frédéric Chambat, Michelle Chapront-Touzé, Christian Gilain, Alexandre Guilbaud, Guillaume Jouve, Françoise Launay, Marie-Laure Massot, François Prin, Christophe Schmit. Paris: CNRS Éditions, 2015. All of the information and references on the correspondence are taken from the collective works of the Groupe D'Alembert to which we refer. The *Inventaire* has benefited from the preliminary works undertaken by Martha Rezler, Gilles Maheu and John Pappas (especially J. Pappas 1989).

[3]See Beaurepaire et al. (2006) and Beaurepaire (2014).

[4]See Passeron et al. (2008).

[5]See A. Guilbaud's article in the present book and our attempt to provide a new way of browsing a mix of print and manuscript documents: http://dalembert.academie-sciences.fr/encyclopedie/Dossier_Affaire_Tolomas/index.php

1 D'Alembert's Mathematical Correspondence as a Part of His Activity

In order to discover which mathematical ideas and crucial scientific issues emerge from D'Alembert's currently extant correspondence, we first of all need a broader mapping of his activities and more precise biographical data than that revealed in the letters, all written after the Minister's letter notifying him of his admission to the Académie Royale des sciences when he was 23.[6]

Jean Le Rond, "newly born" when he was "found" on the steps of the church St-Jean-Le-Rond on October 16th, 1717, was baptised after the name of the patron saint of that very church. This was a name of which he was unaware for the part of his youth spent with his wet nurse,[7] his boarding school master and at the Collège Mazarin, thinking at the time that his name was "d'Aremberg."[8] He obtained a Master of Arts degree (maître ès arts) in 1735 under the name of Jean Le Rond, and it is only before entering the Académie that he took, from then on, the name of D'Alembert.

It is therefore Jean Le Rond D'Alembert, scholar with a complex identity,[9] member of the most prestigious European Academies,[10] who died in Paris on October 29th, 1783, at the "Château du Louvre," in the apartment to which he was entitled as Permanent Secretary of the Académie française.

As we must have knowledge of his scientific work (his treatises, academic memoirs, participation in the Académie awards and his expert reports) and analyse his publishing strategies, a third cartography is necessary, that of the social connections his position in the enlightened world enabled him to establish at various stages of his life.

We will discuss the context in which his discussions took place with the Basel native Leonhard Euler[11] (during Euler's time in St. Petersburg and Berlin) and the Genevan Gabriel Cramer.[12]

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[6]D'Alembert (2015), letter 41.01 from Maurepas to D'Alembert, May 13, 1741, p. 3–4.

[7]See F. Launay (2010).

[8]See F. Launay (2012).

[9]For this complexity, see I. Passeron (2009).

[10]Académie royale des sciences of Paris (1741), Academy of Berlin (1746), Royal Society of London (1748), Académie française (1754), Academy of Stockholm (1755), Institute of Bologna (1755), Imperial Academy of Saint Petersburg (1764), and many others throughout Europe.

[11]Leonhard Euler (1707–1783), *princeps mathematicorum,* was born in Basel. After his Saint Petersburg period, from 1727 to 1741, he took up a position at the Berlin Academy (1741), where he spent 35 years, before returning to Russia. During his very fruitful Berliner period, he was elected "associé étranger" of the Académie royale des sciences of Paris (1755) and won a great number of Academy Prizes. At least 40 letters were exchanged between both scholars.

[12]Gabriel Cramer (1704–1752) was a Genevan mathematician, not to be confused with Voltaire's publisher of the same name, Gabriel Cramer (1723–1793). We know that 25 letters were exchanged between Cramer and D'Alembert, of a very friendly nature, and we also have evidence that some are missing (D'Alembert 2015, p. xli).

Finally, a mapping of the entanglement of the Republic of Letters and the Republic of Sciences, which was still in its early stages, will enable us to identify the part played by D'Alembert as he became renowned for solving mathematical problems, or the forms of interactions existing between these resolutions and his epistemological positions, expressed not only, for example, in the *Encyclopédie*, for which he wrote the well-known *Discours préliminaire*, but also in his roughly 1700 articles on physics and mathematics.[13]

2 The Characteristics of D'Alembert's Correspondence

Now that these biographical points have been made, we can thereby evaluate the significance of the extant correspondence of D'Alembert: 2300 letters sent or received, none of which were from relatives (which is partly explained by the fact that he had been abandoned and unrecognised, as well as being childless). However, the definition of an epistolary corpus must be specified, because the very notion of a "letter" has different facets, from the private letter, passed from hand to hand, to the ostensible letter,[14] or even the fake letter.[15] Additionally, further evaluation has led to further doubts: we counted up to 450 correspondents, but their identities are sometimes uncertain, and may even mask multiple authors. Finally, in what is probably the most difficult aspect to assess, one that is too often obscured by the inventories, we need to determine the way in which these 2300 letters and 450 interlocutors are representative of D'Alembert's correspondence, which implies that we need to discover why and how letters have been kept, gathered, destroyed or lost.[16]

Unlike others, D'Alembert did not keep an epistolary register, and we might even say that he was not at all interested in doing so. What is obvious, however, is that we only have a fraction of his correspondence, and that only exchanges with correspondents who were, for various reasons, "privileged," such as Voltaire[17] and

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[13]For specific studies on D'Alembert's articles, see (online) the file "D'Alembert et l'*Encyclopédie*" in *RDE 21* (Chouillet 1996), *Les branches du savoir dans l'*Encyclopédie*, RDE 40–41* (Leca-Tsiomis and Passeron 2006) and Gilain (2010), Guilbaud (2012), Schmit (2014).

[14]An "ostensible", or conspicuous letter is a letter written for the purpose of being shown or written knowing it would be shown (see D'Alembert 2015, Introduction, Privé *versus* Public, pp. xiv–xvii). Some of these, the most "ostensible" (from A43.10 to A83.01), are listed in D'Alembert (2009, Appendice, pp. 518–547). We have listed 2300 private and ostensible letters, excluding the fake and apocryphal ones.

[15]For fake and apocryphal letters, see D'Alembert (2009, p. xv and pp. 549–551) and D'Alembert (2015, Introduction, Lettres apocryphes, p. xvi).

[16]See D'Alembert (2015), Introduction, pp. xxi–xxiii.

[17]The correspondence with Voltaire begins in 1746 and comprises over 527 letters (known so far) until the death of the latter. See D'Alembert (2009), Introduction, pp. xxviii–xxix.

Frederick II,[18] or important figures within mathematics, such as Euler, Cramer and Lagrange,[19] have been rather well preserved. The density of these written records must not, however, overshadow the many oral discussions he had with Diderot,[20] Condillac,[21] Clairaut[22] and De Gua[23] that were not followed up in writing.

D'Alembert often wrote for the purpose of cultivating intellectual and amicable relations disrupted by distance (as was the case with Cramer after he left Paris in 1748), but also to follow academic activities, and even support them in cases of priority disputes (as with Euler, whom he never met) or to clarify his reasoning (with Lagrange).

Therefore, the only means to evaluate the way in which the letters are purported to differ from academic relations and information transfers through periodicals and prints is to compare their substance with what we learn from accounts of institutional life and the various circulations of printed matter.

D'Alembert's extant correspondence is very unevenly distributed:

Apart from his nomination letter as "adjoint" at the Académie royale des sciences in 1741, none of the letters written before 1746, the year he turned 29, have been preserved. This gap is largely due to his status as a "bastard," *nec pater nec res*,[24] and even more to the fact that he was childless. He had, however, more than one adoptive family: his foster family, the Rousseaus,[25] a family of glaziers with whom

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[18]The correspondence with Frederick II (1712–1786, King of Prussia from 1740) begins in 1746 and comprises over 285 letters (known so far), until D'Alembert's death. See D'Alembert (2009), Introduction, p. xxvi–xxvii.

[19]Joseph Louis (Giuseppe Luigi) Lagrange (1736–1813), was a member of the Berlin Academy (1756) and of the Académie royale des sciences of Paris (1772). Their correspondence begins in 1759 and comprises over 172 letters, until D'Alembert's death. See D'Alembert (2009, Introduction, pp. xxviii–xxxi).

[20]In regard to his friend and colleague Denis Diderot (1713–1784), only one letter is known (D'Alembert 2009, letter 65.39). Like many Parisians, D'Alembert and Diderot ("Da and Di" as Voltaire said in his letter to Damilaville on April 8th, 1765) probably sent short letters to each other, all of which were lost.

[21]Also a friend from his early years, Etienne Bonnot de Condillac (1714–1780) had a great influence on D'Alembert's philosophy. No letters have been found, despite evidence of the existence of at least one (D'Alembert 2009, pp. xxxiv–xxxv).

[22]Alexis Claude Clairaut (1713–1765) was not a friend, but rather a stimulating rival, which is also a good circumstance under which to send and receive letters, although only a few letters are known of (D'Alembert 2009, letters 59.08, 59.09, 64.24, 64.25, 64.30 and ostensible letters A61.06, A62.05, A62.01, A62.06).

[23]Very little is known about the relationship between D'Alembert and the editor of the first project of the *Encyclopédie*, Jean Paul De Gua de Malves (1710–1786), except that they were close colleagues in the 1740s. No letters between the two academicians remain, an unsurprising fact, given that De Gua's correspondence and D'Alembert's correspondence of the 1740s have both disappeared.

[24]"Neither father nor fortune": to understand how these words gave rise to the "Affaire" with Jesuit Father Tolomas, see the interface mentioned note 6.

[25]D'Alembert's well known wet-nurse, "Mme Rousseau", was not very famous before the publication of F. Launay's study (Launay 2010): she was born Etiennette Gabrielle Ponthieu

D'Alembert lived in Le Marais until he reached the age of 48, and the family who served as his official guardians, the Destouches,[26] from whom he received a pension and with whom he was very close. The social status of the Rousseaus and the fact that the members of the Destouches family were simply benevolent guardians explains why D'Alembert did not write to them or, if he did, which was probably the case with the Destouches family at least, why these exchanges were not kept on either side. Furthermore, in 1746, he had already written two major works,[27] and there must have been exchanges, with Maupertuis,[28] for instance, one of his supporters at the Académie des sciences who had, at the time, left for Berlin. Therefore, a number of D'Alembert's letters were not kept, and were most likely discarded while he was still alive.

Besides, another imbalance is due to the fact that we have more letters sent by D'Alembert than those received by him: the scholar kept fewer of his letters than his correspondents did.[29] What is more, D'Alembert's fame as Secretary of the French Académie and as the "leading light" of French philosophers[30] ensured the preservation of certain of his letters from the eighteenth century to the present.

If we now examine the chronological distribution of the letters and correlate it with their actual content, we notice a connection between their volume and the scholar's official career. Indeed, it increases at the time of the *Encyclopédie*, except during the mysterious 1759 "gap,"[31] and reaches its peak during the activities of the salon that he hosted together with Mlle de Lespinasse[32]; it then remains substantial, thanks to his envied status as Permanent Secretary.

More specifically, during the early years, this correspondence was largely fuelled by his exchanges with Euler. These stopped due to profound disagreements, and even disputes, as was the case in 1751, and it was only in the 1760s that the

(1682–1775), and when D'Alembert was born in 1717, she had taken the name "Mme Gerard" after her first marriage; she then took the name of her second husband, the glazier Rousseau, in 1726.

[26]Louis Camus Destouches (1667–1726), one of Fenelon's friends, was the first to be in charge of the young "Jean d'Aremberg". When he died, his brother Michel, and finally Michel's widow (in 1731), continued to provide for him (1200 livres tournois every year), guiding his first steps in the world (Launay 2012).

[27]*Traité de dynamique* (D'Alembert 1743), which contains the famous "D'Alembert's principle" and *Traité de l'équilibre et du mouvement des fluides* (D'Alembert 1744).

[28]Pierre Louis Moreau de Maupertuis (1698–1759), "the man who flattened the Earth", led an expedition to Lapland to determine the shape of the Earth (1736–1737), an issue at stake in the Newtonian-Cartesian controversy. He was then invited by Frederick the Great to be the first President of the Prussian Academy of Science (Terrall 2002).

[29]See D'Alembert (2015, Introduction, pp. xxi–xxiii).

[30]As Chevalier de Roubin said: "puisqu'avec raison on vous regarde comme le flambeau de l'europe, c'est vers vous qu'il faut aller pour etre éclairé" (D'Alembert 2009, letter 73.84).

[31]See Fig. 1.

[32]Julie Jeanne Eleonore de Lespinasse (1732–1776), an illegitimate child like D'Alembert, became famous after she broke her friendship with Mme Du Deffand (1764) and set up her own "salon", "rue Saint-Dominique", where she lived with D'Alembert until her death.

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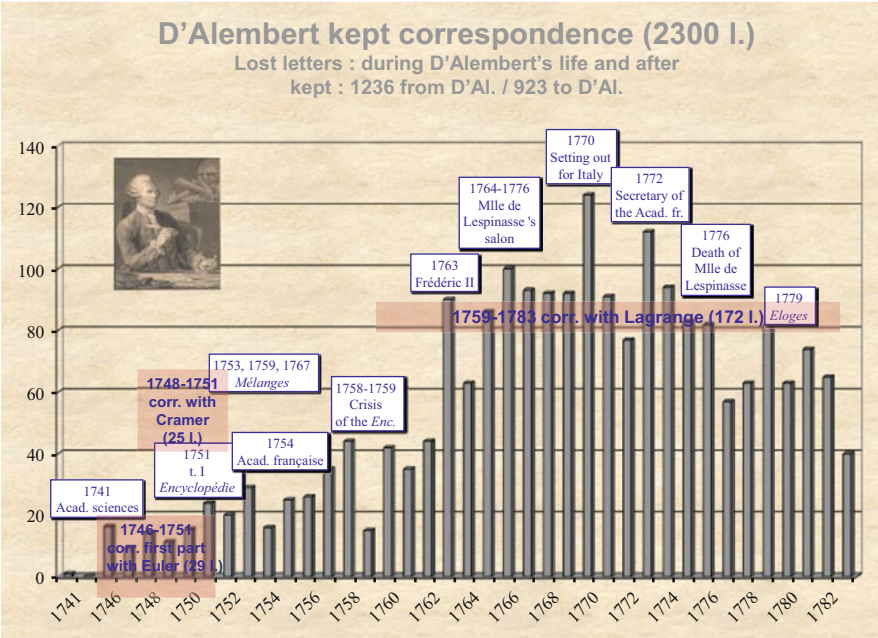

Fig. 1 Kept correspondence from and to D'Alembert

correspondence was resumed. The 30 letters exchanged between 1746 and 1751 (out of 40 in total) are thus the most important, as they shed a completely new light on the works of both scholars during that period: the fundamental theorem of algebra, the vibrating strings,[33] the theoretical crisis over Newton's theory of gravitation, hydrodynamics, all elements that contributed to the genesis of the views of both scholars, views they developed in their printed memoirs in a way that smooths over the debates.

We are also lucky to possess, as a counterpoint, the discussions that both had with the Genevan scholar Gabriel Cramer. Cramer's stay in Paris in 1747–1748 gave rise to a very close friendship between the two mathematicians, most likely *via* the salons of Mme Geoffrin[34] and Mme Du Deffand.[35] But it was also a friendship between philosophers: the theory of infinity, the theory of music, a large number of issues brought them together and led to fruitful exchanges, the echoes of which can

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[33] In particular, a recently discovered letter from Euler, D'Alembert (2015, pp. 39–47, letter 46.12).

[34] Mme Geoffrin, born Marie Thérèse Rodet (1699–1777), was linked with the Genevan patricians, the Saladins. Her "salon" was probably where D'Alembert met Cramer during his stay in Paris.

[35] Mme Du Deffand, born Marie de Vichy-Chamron (*c.* 1697–1780), was, at the beginning, a very dear friend of D'Alembert's, and supported him in 1754 in his election to the Académie française. Upset after her break with Mlle de Lespinasse, she was, at the same time, angry with D'Alembert and never forgave him for the choice he had made.

be found even in the *Discours préliminaire* and in the articles of the *Encyclopédie*.[36] Cramer's death in January 1752, of course, put an end to these exchanges.

It is only with Lagrange that D'Alembert was once more to have a genuine scientific exchange, over a long period of time and with growing intensity, from 1759 until his death.

The figure represents what we call "private letters," even if there is no universal definition of such letters. D'Alembert wrote at a period during which the channels of expression were increasingly diversified through periodicals, but even though the gradation of existing intermediaries makes it difficult, we can still distinguish, in most cases, between the letters that were "ostensible" and those that were "private."[37]

It is not always easy to identify the sender or the recipient of a letter: it could be an institution[38] or it could also be more than one person. For instance, when Mlle de Lespinasse dictated a letter to D'Alembert, which was destined for Condorcet,[39] the "secretary" was no longer "permanent" but "private," and he took the liberty of including personal jokes.[40] In addition, some people wrote letters that they knew, or else pretended not to know, would be used publicly by, for example, being read in the salons, being copied or even printed.

Finally, as far as some of the letters are concerned, we only know that they were written to a woman or to an unidentified collaborator in the *Encyclopédie*, or we have no certainty as to the identity of either the sender or the recipient.

We had to leave out all writings (notes, certificates or receipts) mistakenly considered as letters by the previous publishers, in order to exclude, but nevertheless report, literary frauds or sheer fabrications, often of slanderous intent. On the other hand, the "Extraits des différentes Lettres de M. d'Alembert à M. de la

[36]For instance, the article "Courbe" of the *Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers*, written by D'Alembert, quotes and praises Cramer's book (Cramer 1750): "ouvrage très-complet, très-clair & très-instructif, & dans lequel on trouve d'ailleurs plusieurs méthodes nouvelles" (*Encyclopédie*, vol. IV, 1754, p. 388a).

[37]See note 15.

[38]*A fortiori* if the sender or the recipient is the permanent secretary of an Academy, it is often impossible to draw a clear distinction between what falls under an individual word and what falls under an academic word.

[39]Marie Jean Antoine Nicolas de Caritat, marquis de Condorcet (1743–1794), was D'Alembert's spiritual son. Unfortunately, their correspondence was lost. See Nicolas Rieucau's contribution in the present book.

[40]Mlle de Lespinasse dictating, D'Alembert writing: "vous avez encore tort de faire de la géométrie comme un fou, de souper comme un ogre et de ne pas plus dormir qu'un lièvre. Vous croyez bien que ce n'est pas mon secrétaire qui dit cela"; "mon secrétaire ne sait jamais ni ce qu'il dit, ni ce qu'il fait—(pure bêtise de dire cela: cette pensée est du secrétaire)"; "il est très incommode de dicter à un homme aussi *admirable* que mon secrétaire, qui fait d'aussi beaux mémoires à l'Académie, ou qui est aussi maussade *à la maison*"; "mon revêche secrétaire veut bien écrire à mon bon Condorcet"; "mon secrétaire et moi, nous vous écrivons en commun"; "le secrétaire vous embrasse et trouve qu'*en voilà assez*. Ce mot est son cachet et vous y reconnaîtrez sa grâce enchanteresse." (D'Alembert 2009, letters 69.46; 69.50; 69.55; 71.77; 72.33; 74.43).

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Grange" (*Mémoires de Turin*, 1765), which we also had to eliminate from this correspondence, although they are worthy of publication as part of D'Alembert's works, were but a stratagem he came up with, in connivance with Lagrange, to publish mathematical texts elsewhere than in the Paris or Berlin academic memoirs.

The great variety and quantity of documents that we possess demonstrate that the boundaries between the public and the private spheres are blurred, and that they are representative of the various positions occupied by D'Alembert: as co-director of the *Encyclopédie*; member of the Académie royale des sciences; Permanent Secretary of the Académie française; but also recipient, as well as sender, of epistles, and therefore both a "public" and a private figure.

3 The Characteristics of D'Alembert's Publications and Manuscripts

D'Alembert's correspondence is closely linked to the printed word[41] and to academic activity.[42] Even the few purely amicable or social letters that have reached us, sometimes miraculously, bear witness to this connection.[43] Indeed, the tumultuous news that they relate is closely connected to literary and political debates.[44]

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[41]This fact illustrates the growing influence of the printing world, even over the growing culture of the private sphere (on this, see Chartier and Martin 1991). For instance, D'Alembert gets acquainted with Euler by sending him his works: "Monsieur de Maupertuis m'a remis tant Votre lettre que Vos ouvrages" (D'Alembert 2015, letter 46.12, p. 39). But, on the other hand, a book can also be linked to an acutely topical issue, when he writes to Cramer: "M. Diderot, mon intime ami, que vous connoissés de reputation, s'est avisé de donner au Public une lettre sur les aveugles, ou il y a d'excellentes choses *sed non erat his locus*", telling his friend living in quiet Geneva that Diderot has been imprisoned in La Bastille following the publication of the *Lettre sur les aveugles à l'usage de ceux qui voyent*, a controversial issue due to his atheistic materialism (D'Alembert 2015, letter 49.09, pp. 227–228).

[42]Almost nothing is known about the debates, if not disputes, which enlivened the academic sessions in Paris or Berlin, but allusions are numerous, for example, when D'Alembert blames Euler for his partiality when examining his paper proposed for the Berlin prize: "Je scai aussi par une voie tres sure qu'il s'est passé bien des *vilainies* sur ce sujet" (D'Alembert 2015, letter 51.15, pp. 348–349).

[43]In a short letter (a "billet" hand-delivered between addresses in Paris) written to his friend, la marquise de Crequÿ, (1714–1803) D'Alembert expresses this proximity in a witty remark: "Je m'amuse à vous ecrire, à condition que c'est pour vous seule, j'ay pourtant assez d'ouvrage: quatre epreuves à corriger, un avertissement a achever, l'Errata du second volume à composer, les Jesuites à batonner, les jansenistes à fustiger . . . " (D'Alembert 2015, letter 51.24, pp. 364–365).

[44]The letters give public information ["Comme j'allais fermer ma lettre il m'est arrivé trois prêtres [. . .] Ils m'ont beaucoup parlé du livre de Buffon et de celuy de Montesquieu, que la Sorbonne veut condamner" (D'Alembert 2009, letter 53.07 to Mme de Crequÿ)] and unofficial information ("A propos de President, le Montesquieu m'a ecrit une assez jolie lettre. Il ne veut point de *democratie et despotisme* mais il est bien tenté de prendre l'article *Goût*. Vous ne vous en seriés jamais douté ny moy non plus.") (D'Alembert 2009, lettre 53.26 to Duché, about Montesquieu's contribution to the *Encyclopédie*).

Treatises	Académie des sciences	Académie française	*Encyclopédie*
	1741: « adjoint »		
1743: *Traité de dynamique*			
1746-1752: works on winds, moon, precession, fluids	1746: « associé »		1751: vol. I *Discours préliminaire*
1752 : *Elémens de musique*		1753 : *Mélanges*	1752 : vol. II 1753 : vol. III
1754-56 : *Système du monde*		1754: member	1754 : vol. IV 1755 : vol. V
	1756: « pensionnaire surnuméraire »		1756 : vol. VI 1757 : vol. VII
		1759 : *Mélanges* + 2 vol.	1759: condamnation
1761: *Opuscules*, t. I-II		1762 : Cath. II's proposition from 1763 : Fréd. II	
	1765: « pensionnaire »	1765-7 : *Jésuites*, *Mél.*+1 vol.	1765: vol. VIII-XVII
	1769: « directeur »		
		1772: « secrétaire perpétuel »	
	1773: Condorcet « secrétaire perpétuel »		1776-7: Supplément
1780: *Opuscules*, t. VII-VIII		1779 : Eulogies	

Fig. 2 Bio-bibliographic landmarks

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If we consider his printed works, we can divide them into four major categories, which are punctuated with biographic landmarks and which differ in their dissemination and audience (Fig. 2).

The first is that of the great scientific treatises. Theses treatises, written between 1743 and 1756, are all centred around a theme: dynamics (1743), fluids (1744), the general cause of winds (1746), the lunar theory (1747–1749), the precession of equinoxes (1749), music (1752) or the world system (1754–1756); and they involve key mathematical issues: partial differential equations of motion and equilibrium, the fundamental theorem of algebra, complex numbers, series. Later on, the *Opuscules* were published (nine volumes in total, although the last remains unpublished) which comprise a collection of various memoirs and in which we find further discussions on these subjects.

In the second category, we find the works related to his activities at the Académie des sciences: the texts he published in his annual *Mémoires*, his expert reports and his role as a member of the prize commission.[45]

The third category is linked to his literary activity, which gained momentum throughout his life and was at its peak after his nomination as Permanent Secretary

[45]These internal texts will be published in volume III/11 "D'Alembert académicien des sciences" of *D'Alembert. Œuvres complètes*, along with the speeches read out on special sessions of the Paris Academy of Sciences.

of the Académie française in 1772. Many of these works address issues relative to language and its formalisation in the Dictionnaire de l'Académie française. He also wrote numerous eulogies,[46] which formed a kind of "catechism" of good scholarly practice.

The fourth category, frequently interacting with the previous ones, is centred on his writings for the *Encyclopédie*,[47] essentially from 1746 to 1759 (the moment when D'Alembert withdrew from the enterprise).

4 D'Alembert, Euler and Cramer Between 1748 and 1752

Having established this groundwork, we can describe more precisely how mathematical information was restored and circulated between D'Alembert, Euler and Cramer from 1748 until 1752, just before and just after the publication of the first volume of the *Encyclopédie*.

If we place these exchanges on a map of Europe, we notice that mathematical correspondence (pure or mixed mathematics), which was the theatre of numerous controversies between the years 1746 and 1752, revolves around two main interlocutors, and therefore two destinations. Apart from his subsequent correspondence with Lagrange, it is during that period that D'Alembert's mathematical exchanges intensify: with Euler in Berlin and with Cramer in Geneva. The intensity of these exchanges enables us to estimate the number of letters that have been lost at approximately 30, but the remaining 55 letters are still very instructive.

Apart from reading the correspondence with the secretary of the Berlin Académie, Formey, having background knowledge of the correspondence of its President, Maupertuis, would be desirable, as he played an important part in D'Alembert's early career at the beginning of the 1740s.[48] It is through him that D'Alembert came into contact with the Berlin Académie of which he then became a member, thanks to the prize he received for his *Réflexions sur la cause générale des vents* in 1746 (the only one he ever received, because the one he applied for next, the prize on resistance of fluids, caused his dispute with Euler). Unfortunately, most of Maupertuis's correspondence has been destroyed, but the few elements that

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[46]These eulogies contributed to his success, as he read a lot of them in the French Academy public sessions, such as the eulogy for Massillon read on August 25th, 1772, or the eulogy for Bossuet read in 1775: "cet endroit a été saisi avec transport par le public, qui a applaudi à enfoncer la salle", as reported by Julie de Lespinasse to Condorcet (Passeron 2009).

[47]He wrote numerous articles in the *Encyclopédie ou Dictionnaire raisonné des sciences des arts et des métiers* about physics and mathematics, and the famous "Discours préliminaire", as well as controversial non- scientific articles: "Collège", on Jesuit education, and "Genève", on Genevan pastors' deism. For more details about these contributions, see the ENCCRE project: http://enccre.academie-sciences.fr/

[48]A letter found recently, from D'Alembert to Father Jacquier, shows that, from 1745 on, Maupertuis asked the French scholar to come to Berlin. See also D'Alembert (2015, Introduction, pp. lii–liii and lxxxi–lxxxii).

remain enable us to see that, in 1752, the negotiations between D'Alembert and Euler on whether or not the memoirs or rectifications should be published in Berlin passed him, and to some extent Formey, by.

D'Alembert and Euler had indeed ceased to communicate by the end of 1751, the former being sickened by what he thought were bad practices on the part of the Berlin mathematician, the latter frightened by the encyclopaedist and showing little interest in exchanging with him.[49] It is obvious that the strong friendship, if we can call it thus, between D'Alembert and Frederick II did not contribute to making D'Alembert agreeable in the eyes of the right-minded and true believer Euler. In the meantime, in Geneva, Cramer did his best to deal with these two great mathematicians.

If we take into account all of the information provided by the bibliographical analysis, the canvas of the mathematical controversies between D'Alembert and Euler during these years appears to be a junction and an overlapping of various antagonisms and alliances.

At first, their exchanges were connected to academic prizes, whether from Berlin or from Paris. It is thanks to D'Alembert's vote that, in 1748, Euler[50] won, amongst many others, the prize related to Jupiter's satellites in Paris. At the time, the points of friction between both scholars were not yet explicit. This mathematical exchange takes its full meaning in the dual context of the French and Berlin academies, *via* Maupertuis,[51] and in D'Alembert's opposition to the French Court, which drew him closer to Berlin as early as 1746.[52] This rapprochement is illustrated by the very flattering dedication of the *Cause des vents* to Frederick the Great, which D'Alembert had carefully worked out in his letters to the Marquis d'Adhemar.[53]

In parallel, between 1747 and 1749, the well-known[54] controversy over the movement of the lunar apsis was in full swing. There was no open rupture

[49]About the ideological differences and scientific focal points between D'Alembert (or Condorcet) and Euler, see Gilain (2013) and D'Alembert (2015, Introduction, § IV, VI and VIII).

[50]At this time, Euler was a well-known mathematician, a member of the Berlin Academy since 1741 and "commissaire" (member of the committee that awards the prizes). He competed prizes of the Académie des sciences, where D'Alembert was also "commissaire", and on the other side, D'Alembert competed Berlin prizes.

[51]Maupertuis was a member of the Académie des sciences from 1723 to 1746, when he left Paris for Berlin, to become President of the Berlin Academy. Frederick II subsequently requested of him that he recruit the best European scholars.

[52]D'Alembert thought he was treated better by Frederick II than by his own king. He was very proud to win the first prize given by the new Berlin Academy, in 1746, and quite angry to be underestimated in France.

[53]Antoine Honneste François, marquis d'Adhemar (c. 1710–1785), was a cavalry captain, friend of the encyclopedists, who left the army in 1752 to become grand-maître at the court of Frederick II's sister, Wilhelmine, Margravine of Bayreuth.

[54]Thanks to the works of Michelle Chapront-Touzé, which made possible the publication of D'Alembert's Lunar theory: see D'Alembert (2002) and also D'Alembert (2006) for the important question of precession of equinoxes.

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(except vis-a-vis Buffon[55]), but rather a fruitful debate between D'Alembert, Euler and Clairaut, although disputes over priority were being hatched. Many questions of pure mathematics underlying the works on the general cause of winds (1746) and on celestial mechanics were raised and discussed: the way to solve the so-called "fundamental theorem of algebra,"[56] which put Euler in opposition to D'Alembert, the relevance of examples and counter-examples, up to the principle of the method itself—algebraic for Euler, analytic for D'Alembert. There again, the epistolary voice of the friend, Cramer, came as a counterpoint, and that of the rival, Clairaut, expressed itself through the *Mémoires* de l'Académie.

Nevertheless, the main reason for the breakdown between Euler and D'Alembert was probably the award for the determination of the fluid resistance laws: as we can see in the correspondence, D'Alembert was convinced that Euler was responsible, as "commissaire" in Berlin, for many "villainies," which prevented him from receiving the prize.[57]

Finally, the publication at the end of 1750 of Cramer's work, *Introduction à l'analyse des lignes courbes algébriques*, was used by D'Alembert to echo and orchestrate his opposition to Euler. Indeed, D'Alembert thought that he had discovered the mistake made by De Gua[58] before Euler, when De Gua [?] affirmed, in his work published in 1740, that no algebraic curve could have a cusp of the second kind. D'Alembert also claimed to be the first to demonstrate analytically the existence of such singular points.

Moreover, his change of position regarding De Gua, although he had written a positive review of his work in 1740, can also be understood in the context of the early stages of the *Encyclopédie*.[59] Indeed, De Gua managed the enterprise from June 1746—at the time, it was just a project centered around translating the two volumes of the *Cyclopaedia*—but in October 1747, the booksellers dismissed him, judging that his work was insufficient, and so they signed a contract with D'Alembert and Diderot, who thereafter became the editors of the *Encyclopédie*.[60]

These beginnings were already tumultuous: Diderot was at the Bastille and Formey was claiming payment for the papers he had given to the enterprise, which De Gua was taking time to pay. D'Alembert intervened in all of these developments, and consolidated his status as an academician who could not be overlooked, despite his unorthodox opinions, particularly in the eyes of Jesuits.

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[55]At this time, the relations between the mathematician D'Alembert and the naturalist Buffon (1707–1788) were friendly, but not close.

[56]See D'Alembert (2007) and Christian Gilain's analysis.

[57]The affair began with the report of the prize in May 1750, and ended with D'Alembert's letter 51.15: see D'Alembert (2015, pp. cxvi–cxx).

[58]See n. 24.

[59]As D'Alembert tells Cramer: "c'est un homme qui se plaint de tout le monde, parce que tout le monde a à se plaindre de luy" (D'Alembert 2015, letter 51.02, p. 313).

[60]For the "prehistory" of the *Encyclopédie*, see Wilson (1985, pp. 73–82).

It is to this type of reconstruction of the ideological landscape that the publication of the *Œuvres complètes* is dedicated. A reconstruction made possible by a detailed analysis of a correspondence, which is at times incomplete, and that makes sense only in light of the whole body of writings that inspired it.

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