

- l'époque de la Révolution française (1793-1807)*, ed. Jean Sagnes (Perpignan: Presses Universitaires de Perpignan, 1993), pp. 11-31; Lluís Roura i Aulinas, *Guerra Gran a la Batalla de França, Catalunya dins la guerra contra la Revolució Francesa, 1793-1795* (Barcelona: Curial, 1993). For the demand that Méchain leave the fort, see AN F17 1326 dos. 18, Méchain to Lavoisier, 11 May 1793.
55. For Méchain's retrospective account of the accident, see AOP E2-19, Méchain to Lalande, 12 floral IV [1 May 1796]. For his immediate, vague account, see AN F17 1326 dos. 18, Méchain to Lavoisier, 11 May 1793. Méchain dated the accident to 1 May 1793; see ENPC MS1504, Méchain to Borda, 10 January 1794. On the pump, see Townsland, *Journey Through Spain*, 1, p. 134-5.
56. AOP E2-19, Méchain to Lalande, 19 ventôse III [9 March 1795].
57. For the Spanish decision to detain Méchain in Spain because war had broken out, see AMNM Leg. 2294/116-117, Consular note, n.d.
58. AN F17 1326 dos. 18, Méchain to Lavoisier, 11 May 1793. The letter is not in Méchain's hand.
59. For Mme Méchain's expectations of her husband's return, see KBD NKS1304, Mme Méchain to Bugge, 19 March 1793. For her worries, see AAS Fonds Lavoisier 1229(2), Lavoisier to Méchain [mid-June 1793]. Lavoisier to Méchain, 15 June 1793, in CUL MS4712+, Lavoisier, 'Registres de l'Académie des Sciences', 1792-3. See also AAS Fonds 1228, Lavoisier to Mme Méchain [mid-June 1793].
60. Lavoisier to Méchain, 29 June 1793, in CUL MS4712+, Lavoisier, 'Registres de l'Académie des Sciences', 1792-3.
61. For Lavoisier's guarantee of the funds, see AAS Fonds Lavoisier 972, Lavoisier, 'Au nom de Antoine-Laurent Lavoisier' [June 1793].
62. AAS Fonds Lavoisier, 1229(2), Lavoisier to Méchain [mid-June 1793]. See also, Lavoisier to Méchain, 15 June 1793, in CUL MS4712+, Lavoisier, 'Registres de l'Académie des Sciences', 1792-3.
63. AAS Fonds Lavoisier 1229(2), Lavoisier to Méchain [mid-June 1793].
64. AAS Fonds Lavoisier 1228(45), Lavoisier to Lakanal [May-June 1793].

### Chapter 5 The Measure of Revolution

1. Thomas Pynchon, *Mason & Dixon* (New York: Holt, 1997), p. 669.
2. Louis-Sébastien Mercier, *Le nouveau Paris* ([Brunswick]: n.p., 1800), 3, p. 44.
3. For the station at Saint-Martin, see AOP E2-6, Delambre, 'Registre', p. 57.
4. For the history of Belle-Assise, see ADSM 30Z216, Froment, 'Monographie de la commune de Joisigny', 1888.
5. For the view of Bruyères, see Delambre, *Base*, 1, p. 137. For his *ancien régime* observations there, see Bigourdan, *Astronomie d'observation*, pp. 170-2.
6. For the old measures stored at the Panthéon, see Lavoisier, 'Rapport sur le local destiné . . . pour les poids et mesures', September 1793, in

- Antoine-Laurent Lavoisier, *Œuvres de Lavoisier* (Paris, Imprimerie Impériale, 1862-93), 6, p. 690.
7. *Journal de la Montagne* (28 messidor II [16 July 1794]), p. 647, quoted in Centre Canadien d'Architecture, *Le Panthéon: Symbole des révolutions* (Tardy, France: Picard, 1989), p. 133-6. On alterations to the Panthéon, see Antoine Quatremère de Quincy, *Rapport fait au directoire du département de Paris, 13 novembre 1792, sur l'état actuel du Panthéon* (Paris: Ballard, 1792).
8. Antoine Quatremère de Quincy, *Rapport fait au directoire du département de Paris sur les travaux entrepris, continués ou achevés au Panthéon français* (Paris: Ballard, II [1794]), pp. 6-7, 17-18. For Delambre's proposed observatory, see AOP MS1035B, Delambre, 'Plan de la lumière du dôme du Panthéon français' [January 1793].
9. AOP E2-19, Delambre to Méchain, 31 March 1793; received in Barcelona in June 1793.
10. BN Rés Ye 3641, Lalande, *Article pour les cabiers dont les 36 rédacteurs sont priés instamment et requis expressément de faire usage* ([Paris]: n.p., 1789).
11. On Lalande's youth, see Julien Raspaill, 'Papiers de Lalande', *La Révolution française* 74 (1921), p. 236-54. On his science, see Jean-Claude Pecker, 'L'œuvre scientifique de Lalande', *Jérôme de Lalande (1732-1807)*, ed. Pecker (Bourg-en-Bresse: Société d'Emulation de l'Ain, 1985), pp. 12-16.
12. For the predicted comet, see Lalande, *Reflexions sur les comètes qui peuvent approcher de la terre* (Paris: Gibert, 1773). For the wag's comment, see BN Vz 1695, [Pierre Hourcastrenne], *Dissertation sur les causes qui ont produit* (Paris: Pougin [1791]), p. 29. For the effects on women, countryfolk and sales of unleavened bread, see Condorcet to Voltaire, 16 May 1773, in Voltaire, *Voltaire's Correspondence*, ed. Theodore Besterman (Geneva: Institut et Musée Voltaire, D18372. Simon Schaffer, 'Authorized Prophets: Comets and Astronomers after 1759', *Studies in Eighteenth-Century Culture* 17 (1987), p. 45-74.
13. Friedrich Melchior Grimm, *Correspondance littéraire*, ed. Maurice Tourneux (Paris: Garnier, 1877-82), 10 (April 1773), p. 235-8.
14. For Lalande's first voyage to England in 1763, see Lalande, 'Journal d'un voyage en Angleterre', ed. Hélène Monod-Cassidy, *Studies on Voltaire and the Eighteenth Century* 184 (1980), p. 5-116. On Lalande's ballooning, see Seymour Chapin, 'What Better Way to Go to Gotha: Lalande, Blanchard, and the Balloon', *Griffith Observer* 47 (November 1985), p. 2-19. On Lalande and the masons, see Louis Aimable, *Le franc-maçon, Jérôme Lalande* (Paris: Charavay, 1889), pp. 22-38.
15. Constance de Salm-Reifferscheid-Dyck, *Eloge historique de M. De La Lande* (Paris: Sajou, 1810), p. 33.
16. Lalande, 'Testament moral', in Aimable, *Lalande*, p. 52.
17. Voltaire to Lalande, 6 February 1775, in Voltaire, *Correspondence*, D19323.
18. Voltaire to Lalande, 11 June 1770, in Voltaire, *Correspondence*, D16404: 'Dans l'univers entier ta gloire est répandue, / Et ce n'est qu'avec lui que périra ton nom.'

19. Denis-Bernard Quatremère-Disjonval, *De l'arandologie* (Paris: Fuchs, 1797), pp. 141-2.
20. For Lalande's height, see CUS, Lalande, 'Passport', 19 prairial VI [7 June 1798]. For Piry, see the correspondence between Lalande and Louise-Elizabeth-Félicité Pourra de la Madeleine du Piry in BYU Lalande papers. Jérôme Lalande, *Astronomie des dames* (1st edn, 1785; 2nd edn, Paris: Cuchet, 1795; later editions in 1806, 1817, 1820, 1841, 1900). For English edition, see Lalande, *Ladies' Astronomy*, trans. W. Pengree (London: Dutton, 1815).
21. Lalande, 'Journal', 1763, in Jules Claretie, *L'empire, les Bonapartes et la cour* (Paris: Dentu, 1871), p. 231.
22. Lalande, 'Mémoires de Lalande', in Salm-Reifferscheid-Dyck, *La Lalande*, pp. 43-4. For his apology, see BNR NAF4073, Lalande to Sophie Germain, 4 November 1797.
23. For enrolments in Lalande's course, see BVCS MS99, Lalande, 'Journal', 1777-1807.
24. Jérôme Lalande, *Abrégé de navigation* (Paris: Chez l'auteur, 1793), p. 3. For his family feeling, see Lalande, 'Testament moral', in Aimable, *Lalande*, p. 52.
25. BYU, Lalande to Piry, 1 messidor II [19 June 1794].
26. BYU, Lalande to Piry, 12 August 1788.
27. On Lalande's star catalogue, see Lalande, *Bibliographie astronomique*, pp. 681-2, 690-4.
28. For Méchain's prize-winning work, see Méchain, 'Recherches sur les comètes de 1532 et 1661', *Mémoires de mathématique et de physique* (Paris: Moutard [1782], 1785), 10, pp. 330-96.
29. KBD NKS1304, Lalande to Bugge, 16 June 1788.
30. For the Mercury sighting see AAS, 'Procès-verbaux de l'Académie des Sciences' 105 (1786), pp. 276-8; Delambre, *Histoire de l'astronomie au dix-huitième siècle*, ed. Claude-Louis Mathieu (Paris: Bachelier, 1827), pp. 564-5; Curtis Wilson, 'Perturbations and Solar Tables from Lacaille to Delambre: The Rapprochement of Observation and Theory', *Archive for the History of the Exact Sciences* 22 (1980), pp. 54-304, especially pp. 268-96.
31. Delambre, 'Joseph-Jérôme Lefrançois de Lalande', *Biographie universelle* (Paris: Michaud, n.d.), p. 612.
32. For Lalande's report on Mercury, see Lalande, 'Sur la théorie de Mercure', *MAS* (1786), p. 272. For the report of the other observer, see Messier, 'Observation du passage de Mercure', *MAS* (1786), pp. 121-4.
33. For Méchain's missed observation of Mercury, see BML 26CA6, Méchain to Cotte, 8 May 1786.
34. CUS, Delambre to Cagnoli, 23 November 1789. On Laplace, see Charles Coulson Gillispie, *Pierre-Simon Laplace, 1749-1827: A Life in Exact Science* (Princeton: Princeton University Press, 1997). For the report on Delambre's prize submission, see 'Rapport de Cassini IV, Lalande et Méchain', 5 July 1788, in AAS 'Procès-verbaux de l'Académie des Sciences' 107 (1788), pp. 176-9.
35. Lalande, *Bibliographie astronomique* [1792], p. 703.

36. For evidence that Delambre and Méchain observed together, see AAS Dossier Méchain, Méchain to Delambre, 29 September [1786]. Delambre asked a friend to intercede for him with Méchain; see CUS, Delambre to Cagnoli, 23 November 1789.
37. AAS Dossier Méchain, Méchain to M. l'abbé de Lambre [Delambre], 29 September [1785/86].
38. Delambre, 'Lui-même'.
39. For pre-Revolutionary discussion of metric reform, see Henri Pigeonneau and Alfred de Foville, eds, *L'Administration de l'Agriculture au Contrôle Général des Finances, 1785-1787, Procès-verbaux et rapports* (Paris: Guillaumin, 1882), pp. 127-8, 324-6, 378, 404. For the first proposals within the Academy, see AAS, J.-B. Le Roy, 'Procès-verbaux de l'Académie des Sciences' 108 (27 June, 14 August 1789), pp. 171, 207. For Prieur's pre-Revolutionary proposals, see BEP Prieur 4.2.4.1, Prieur, 'Mesure universelle, Extrait du Journal encyclopédique' (1785), p. 491. For his post-Revolutionary proposals, see Prieur to Louis XVI, April 1790, in Georges Bouchard, *Un organisateur de la victoire: Prieur de la Côte-d'Or* (Paris: Clavreuil, 1946), pp. 458-9; also, Claude-Antoine Prieur-Duvernois, *Mémoire sur la nécessité et les moyens de rendre uniformes dans le royaume toutes les mesures* (Dijon: Causse, 1790). For a survey of various ancien régime proposals, see Ronald Zupko, *Revolution in Measurement: Western European Weights and Measures Since the Age of Science* (Philadelphia: American Philosophical Society, 1990).
40. Tillet and Abeille, *AP* 11 (6 February 1790), pp. 466-86. Tillet and Abeille cited Lalande's proposal and reproduced a portion of his article from the *Tribut de la Société Nationale de Neuf-Sœurs* 1 (1790), pp. 7-16, in *AP* 11 (6 February 1790), pp. 486-7. The only surviving copy of this volume of the *Tribut* has apparently been lost from the Bibliothèque Nationale.
41. Talleyrand, *AP* 12 (9 March 1790), p. 106. Identical phrasing can be found in Condorcet's proposal in BI MS833. Also, Talleyrand admitted that he had consulted 'men of art'; see Talleyrand, *Mémoires* (Paris: Bonnot, 1989), 1, p. 134.
42. For the old Paris toise, see Charles Wolf, 'Recherches historiques sur les étalons de l'Observatoire', *Annales de chimie et de physique*, 5th series, 25 (1882), pp. 5-112.
43. On units of weight, see A. Birembaut, 'Les deux déterminations de l'unité de masse du système métrique', *Revue d'histoire des sciences* 12 (1959), pp. 25-54.
44. On Stevin, see René Taton, 'La tentative de Stevin pour la décimalisation de la métrologie', in *Acta Metrologiae Historicae*, ed. Gustav Otruba (Linz: IIIe Congrès International de la Métrologie Historique, 1983), pp. 39-66. On Vauban, see Sébastien Le Prestre de Vauban, 'Description géographique de l'élection de Vezalay', *Projet d'une dicme royale* (Paris: Alcan, 1933). On Lavoisier, see Lavoisier, *Traité élémentaire de chimie* [1789], in *Œuvres*, 1, pp. 248-51. On the ease of calculation, see Laplace, 'Mathématiques', *Séances des Ecoles Normales [de l'an III], Leçons* (Paris: Reynier [1795]), 1, pp. 10-23. On the naturalness of the

- decimal system, see [René-Just Haüy], *Instructions sur les mesures déduites de la grandeur de la terre*, 1st edn (Paris: Imprimerie Nationale, II [1794]), pp. xxvii-xviii.
45. On base 12, see A. G. Leblond, *Sur la fixation d'une mesure et d'un poids - lu à l'Académie des Sciences, 12 mai 1790* (Paris: Demonville, 1791); also Rollin, 12 frimaire II [22 November 1793], in *PVCIIP*, 3, pp. 88, 90-1. For base 8, see Guérault, *Observations sur la proposition faite par le Cit. Prieur* (Paris: Guérin [1796-7]), p. 5. For base 2 (and 4), see CNAM R14, Leturc to Citoyens agents, 4 fructidor III [21 August 1795]. For base 11, see the views of Lagrange, in Laplace, 'Mathématiques', *Ecoles Normales*, 1, p. 23. For attacks on those who preferred base 7 and 11, see Charles-Etienne Coquebert [de Montbre], 'An Account of a New System of Measures Established in France', *Journal of Natural Philosophy* 1 (August 1797), p. 195.
46. Leblond, *Sur la fixation d'une mesure*, 10.
47. Mercier, *Le nouveau Paris*, 3, p. 44.
48. For various seventeenth-century pendulum proposals, see Isaac Beeckman to Marin Mersenne, 7 October 1631, in Mersenne, *Correspondance du P. Marin Mersenne* (Paris: Beauchesne, 1932-88), 3, pp. 209-10; Christian Huygens, *Horologium Oscillatorium* (Paris: Muguet, 1673), sect. 4, prop. 25. For eighteenth-century attempts, see Turgot to Messier, 3 October 1775, in Etienne-François Turgot, *Œuvres* (Glashtitten im Taunus: Auvermann, 1972), 5, pp. 31-3; Turgot to Condorcet [1775], in *Correspondance inédite de Condorcet et de Turgot 1770-1779*, ed. Charles Henry (Paris: Charavay, 1885), pp. 254-5; Keith Michael Baker, 'Science and Politics at the End of the Old Regime', in *Inventing the French Revolution: Essays on French Political Culture in the Eighteenth Century* (Cambridge: Cambridge University Press, 1990), pp. 153-66.
49. Talleyrand, *AP* 12 (9 March 1790), pp. 104-8. Talleyrand and Miller were in regular communication; see Yves Noël and René Taton, 'La réforme des poids et mesures, Origines et premières étapes (1789-91)', in *Œuvres de Lavoisier*, vol. 7, *Correspondance*, ed. Patrice Bret (Paris: Académie des Sciences, 1997), 6, pp. 339-65. John Riggs Miller, *Speeches in the House of Commons upon the Equalization of the Weights and Measures of Great Britain* (London: Debrett, 1790).
50. BI MS883 fol. 34, Condorcet, 'Sur une mesure commune', n.d. Jefferson worked closely with David Rittenhouse (a mathematician) and Robert Leslie (a watchmaker). For an overview of early American efforts for metric reform, see Julian P. Boyd, 'Report on Weights and Measures', in Thomas Jefferson, *The Papers of Thomas Jefferson*, ed. Julian P. Boyd (Princeton: Princeton University Press, 1950-), 16, pp. 602-17. See also C. Doris Hellman, 'Jefferson's Efforts toward the Decimalization of United States Weights and Measures', *Isis* 16 (1931), pp. 265-314. In 1785 James Madison had also suggested basing a standard of measure on the pendulum; see Madison to James Monroe, 28 April 1785, in *The Writings of James Madison*, ed. Gaillard Hunt (New York: Putnam, 1901), 2, pp. 142-3. For the early involvement of the US government in

- metric matters, see Sarah Ann Jones, *Weights and Measures in Congress: Historical Summary*, National Bureau of Standards, Miscellaneous Publication M122 (Washington, DC: US GPO, 1936).
51. *AP* 15 (8 May 1790), p. 439. This proposal was passed by the king in *Proclamation du roi sur le décret de l'Assemblée Nationale du 8 mai 1790*, 22 August 1790 (Paris: Imprimerie Royale, 1790).
52. For Miller's praise, see Miller, *Speeches* (1790), pp. viii-iv, xiv. Jefferson to Speaker of the House, 4 July 1790, in Jefferson, *Papers*, 16, p. 653. See his First Report (April 1790), Second Report (20 May 1790) and Final Report (4 July 1790), in Jefferson, *Papers*, 16, pp. 623-48. For Jefferson's earlier preferences, see Jefferson to Leslie, 27 June 1790, in Jefferson, *Papers*, 16, p. 576. For the preference of one Paris savant, see Brisson, 'Essai sur l'uniformité de mesures' (14 April 1790), *MAS* (1790), pp. 722-6.
53. [Laplace], 'Discours', 4 messidor VII [22 June 1799], in Delambre, *Basc*, 3, p. 585. The speech is unsigned, but was delivered by Laplace; see Bigourdan, *Système métrique*, pp. 160-6.
54. Borda, 'Rapport à l'Académie des Sciences', 19 March 1791, *AP* 24 (26 March 1791), pp. 379, 394-7.
55. On the debates over geodesy, see Jean-Jacques Levallois, *Mesurer la terre: 300 ans de géodésie française* (Paris: Presses de l'Ecole Nationale des Ponts et Chaussées, 1988); Mary Terrall, *The Man Who Flattened the Earth: Maupertuis and the Science in the Enlightenment* (Chicago: University of Chicago Press, 2002). Also see Mary Terrall, 'Representing the Earth's Shape: The Polemics Surrounding Maupertuis's Expedition to Lapland', *Isis* 83 (1992), pp. 218-37; Rob Iliffe, 'Aplatiseur du monde et de Cassini', *History of Science* 31 (1993), pp. 335-75; John L. Greenberg, *The Problem of the Earth's Shape from Newton to Clairaut: The Rise of Mathematical Science in Eighteenth-Century Paris and the Fall of 'Normal' Science* (Cambridge: Cambridge University Press, 1995).
56. Fontenelle, 'Physique', in *HAS* 1 (1674, pub. 1735), p. 178. See also d'Alembert, 'Pendule', *Encyclopédie*, 12, p. 294.
57. Condorcet to President of the National Assembly, and Borda, 'Rapport', in *AP* 24 (26 March 1791), pp. 379, 394-7.
58. BLL Add MS33272, ff. 97-8, Charles Blagden to Joseph Banks, 8 September 1791, emphasis in original.
59. Jefferson, 'Memorandum to James Monroe', before 4 April 1792, in Jefferson, *Papers*, 27, pp. 818-22. Jefferson received a copy of the French meridian law from Condorcet, translated it himself and wrote back 'to confess that it is not what I would have approved'; see Condorcet to Jefferson, 3 May 1791, Jefferson to Short, 28 July 1791, Jefferson to Condorcet, 30 August 1791, in Jefferson, *Papers*, 20, pp. 353-60; 20, pp. 686-91; 22, pp. 98-9.
60. Borda's new budget came to 300,000 livres; see AN F12 1289, [Académie des Sciences], 19 March 1791. The decree of 20 August 1790 had set the Academy's total budget at 93,458 livres; see *PVCIIP*, 1, p. 260n. For contracts with instrument-makers, see AN F12 1289, Borda to Pavé (Min. Int.), 12 brumaire II [2 November 1793]. For a

- description of Lenoir – he was four foot ten inches tall – see CNAM R6, 'Etienne Lenoir, Certificat de résidence', 22 floréal II [11 May 1794]. On the personnel in Lenoir's shop, see AAS Lavoisier 1967, Lavoisier, 'Etat des ouvriers et coopérateurs' [1793].
61. Mercier, *Le nouveau Paris*, 3, p. 44.
  62. Jean-Paul Marat, *Les charlatans modernes; ou, Lettres sur le charlatanisme académique* ([Paris]: n.p., 1791), p. 40.
  63. On Borda's motives, see Delambre, *Grandeur*, pp. 202–3, 213; also Lalande, *Bibliographie astronomique*, p. 718. On Laplace's motives, see Laplace, 'Mathématiques', *Ecoles Normales*, 5, pp. 203–14.
  64. BN Vz 1695, [Pierre Hourcastrenne], *Dissertation sur les causes qui ont produit* (Paris: Pougin, [1791]), pp. 18–19. For speculation about change in the shape of the earth over time, see Laplace, 'Mathématiques', *Ecoles Normales*, 5, p. 212. For other objections to the meridian, see AN A34 1037, 'Observations sur le rapport relatif au choix d'une unité de mesure', n.d. AN AF11 67 plaq. 496, Guerout, *Observations sur le nouveau système des poids et mesures* (Paris: Roussey, II [1794]).
  65. For Lalande's objections, see AP 11 (6 February 1790), pp. 486–7.
  66. Delambre, 14 April 1793, in Bigourdan, *Système métrique*, pp. 128–30.
  67. For Delambre's passport, see ADSe 3AZ259, Destournelles and Coulenbeau, 'Extrait de registres des délibérations du Conseil Général', 15 April 1793. The passport itself was granted on 24 April; see BMA Arch Rev 2K10, Delambre, 'Pétition', 9 August 1793. See Delambre's account in Delambre, *Base*, 1, pp. 41–2. For one of Delambre's cautionary letters, see BMA 1953(17), Delambre to [?], 31 March [1793].
  68. For Delambre's dossier, see BMA Arch Rev 2K10, Delambre, 'Pétition', 9 August 1793.
  69. AOP E2-6, Delambre, 'Registre', p. 127. See also AOP MS1033c, Garcia to Delambre, 7 June 1793.
  70. For Delambre's progress from Watten to Bayonvilles, see AOP E2-6, Delambre, 'Registre', pp. 132–98; AAS Cabrol 120/121, Delambre to Lavoisier, 11, 16 July 1793; Delambre, *Base*, 1, p. 44.
  71. CUS, Delambre to Amélie Lefrançois, 22 August 1793.
  72. For Lalande's hopes for his nephew's election, see CUS, Lalande to Delambre, 28 July [1793].
  73. AAS Lavoisier 1128(41), Lavoisier to Delambre, [August 1793]. See the advance warning of the Academy's demise, which Lavoisier provided to Delambre in AAS Bertrand Col. 4, Lavoisier to Delambre, 23 July 1793.
  74. BNRC Ge DD 2066 (3), Cassini IV, 'Mémoires, 2ème dialogue', p. 31. For attempts to save the Academy, see *PVCIP*, 2, pp. 240–60. For the Academy in general, see Roger Hahn, *The Anatomy of a Scientific Institution: The Paris Academy of Sciences, 1666–1803* (Berkeley: University of California Press, 1971).
  75. The demand for a 'provisional' metre had been first made by Roland; see AP 41 (3 April 1792), p. 100. First presented to the CIP by Arbogast, 'Rapport', July 1793, in *PVCIP*, 2, pp. 9–20. Based on a report by Borda, Lagrange and Monge to the Academy of Sciences

- and sent to the committee on 29 May 1793. For the legislation, see AP 70 (1 August 1793), pp. 70–4, 112–18. BN Le38 2501, Arbogast, *Sur l'uniformité et le système général des poids et mesures* (Paris: Imprimerie National, 1795).
76. For Borda's estimate, see AAS Chabrol 1/71, Borda to Condorcet [May 1792].
  77. For the metric needs of the cadastre, see Jean-Baptiste Jollivet, *Rapport et projet de décret sur une nouvelle et complète organisation de la contribution foncière*, 21 August 1792 (Paris: Imprimerie Nationale, 1792), pp. 151–81. For the calculation of the provisional metre, see AAS, 'Procès-verbaux de l'Académie' 110 (19 January 1793), pp. 327–35; published as Borda, Lagrange and Laplace, 'Fait à l'Académie des Sciences, sur l'unité des poids et mesures et sur la nomenclature de ses divisions', in CUL QC89. F8A16, *Recueil de pièces relatives à l'uniformité des poids et mesures* ([Paris]: n.p., 1793).
  78. CUS, Lalande to Delambre, 2 frimaire II [23 November 1793].
  79. For Amiens, see AAS Dossier Delambre, Delambre to Lavoisier, 18 August 1793. AOP MS1033c, Delambre, 'Mérédien de France (Partie du Nord)', [1793–4].
  80. [Delambre], 'Proposition d'un citoyen', *Affiches du Département de la Somme* 28 (9 July 1791), pp. 120–1. For Delambre's participation in the Société, see BMA Arch. Rév. 315(1), 'Société des Amis de la Constitution', 16 April 1791. Delambre did not visit Amiens once between 1782 and 1790; see Bigourdan, *Astronomie d'observation*, p. 169.
  81. [François-Noël Babeuf], *Affiches du Département de la Somme* 29 (16 July 1791), p. 125; 30 (23 July 1791), p. 128, in M.-J. Foucart, 'Un aspect inconnu de Babeuf à l'éché charnière de 1791', *Société des Antiquaires de Picardie* 62 (1989), pp. 371–9.
  82. For salaries on mission, see AAS Dossier Delambre, Delambre to Lavoisier, 18 August 1793. Delambre, 'Mesure du méridien, dépense faite par Delambre', 26 floréal III [15 May 1795], in *Observatoire de Paris, Longueur et temps* (Paris: Observatoire de Paris, 1984). Delambre, *Grandeur*, p. 281.
  83. Delambre to Lavoisier, 13 frimaire II [3 December 1793], in Bigourdan, *Système métrique*, p. 132.
  84. Jacques Sover, 'Un acte de vandalisme dans le département du Loiret en l'an II', *Bulletin de la Société Archéologique et Historique de l'Orléanais* 18 (1917), pp. 99–106.
  85. At Châtillon, see AOP E2-6, Delambre, 'Registre', p. 270.
  86. Lagrange [CPM] to Delambre, 8 nivôse II [28 December 1793], in Bouchard, *Prieur*, p. 461. See also Lagrange to Comité de Salut Public, 8 nivôse II [28 December 1793]; Carnot and Lindet, 9 nivôse II [29 December 1793], in Bouchard, *Prieur*, pp. 461–2.
  87. For Delambre's request for a delay, see ENPC MS724, Delambre to [Lagrange, CPM], 13 nivôse II [2 January 1794]. Delambre, *Base*, 1, p. 48.
  88. Delambre noted in the margin that the commissioner was Prony in KM, Delambre, *Base*, 1, p. 48. See also Bigourdan, *Système métrique*,

- p. 133; ENPC MS724, CPM to Commission de Substances, 15 nivôse II [4 January 1794].
89. Denis Lottin, *Recherches historiques sur Orléans* (Orléans: Jacob, 1838), 4, pp. 195, 427-8.
  90. For Delambre's estimate of 1200 *lieues* (2400 miles), see Delambre, 'Mesure du méridien, dépense faite par Delambre', 26 floréal III [15 May 1795], in *Observatoire de Paris, Longueur et temps*; see also ENPC MS726, Delambre, 'Mesure du méridien', 19 messidor II [7 July 1794].
  91. AOP E2-6, Delambre, 'Registre', 3 pluviôse II [22 January 1794].
  92. Delambre, *Base*, I, p. 49. See also ENPC MS724, Min. Int. to Prony, 18 nivôse II [7 January 1794].
  93. AN AF II 67 plaq. 496, Prieur, Barère, Carnot, Lindet and Billaud-Varenne, 'Le Comité de Salut Public, considérant combien . . .', 3 nivôse II [23 December 1793]. For the published version, see *RACSP*, 9, p. 600. Note that in Delambre, *Base*, I, p. 50, Delambre gives the names of the signatories as the three (dead) radicals Robespierre, Couthon and Collot-d'Herbois, rather than the three (living) engineers-moderates who actually signed the order: Prieur, Carnot and Lindet. However, he corrects this deliberate change in a marginal note in KM, Delambre, *Base*, I, p. 50.
  94. AOP E2-19, Delambre to CPM, 4 pluviôse II [23 January 1794].
  95. For d'Assy's arrest, see AN F7 4722, Comité de Sûreté Générale 'Geoffroy d'Assy', 6 pluviôse II [25 January 1794].

#### Chapter 4 The Castle of Mont-Jouy

1. Blaise Pascal, *Pensées sur la religion*, ed. Louis Lafuma (Paris: Luxembourg, 1951), pp. 52-3, (fragment 60-108).
2. AOP E2-19, Méchain to Lalande, 19 ventôse III [9 March 1796]. News of Méchain is found in CUS, Lalande to [Delambre], 28 July 1793. For the effect of heat on the circle, see AOAB Cart. 88, Méchain to Orani, 2 April 1795.
3. Jaume Carrera Pujal, *La Barcelona del segle XVIII* (Barcelona: Casa Editorial, 1951), v. 1. Maldà, *Calaix de Sastre*, 2, pp. 91-3. Torreilles, *Perpignan*, 2, pp. 62-3.
4. On Méchain's pay, see AAS Lavoisier 1228 (36), Lavoisier to Méchain, 6 October 1793. For Méchain's deference to the defunct Academy, see AOP E2-19, Méchain to Borda, 10 January 1794. For Méchain's fears of replacement, see AOP E2-19, Méchain to Borda, 10 January 1794. For Delambre's speculation as to why he was purged while Méchain was spared, see Delambre, *Grandeur*, p. 214.
5. For rumours in Paris that Méchain had received outside (foreign) offers of employment, see KM, Delambre, *Base*, I, p. 52. For the correspondence regarding Méchain's funds, see CUL MS4712+, Lavoisier, 'Registres de l'Académie des Sciences', pp. 1792-3.
6. For Delambre's offer to help, see ENPC MS724, Delambre, 'Mesure du méridien', 19 messidor II [7 July 1794].

7. ADPO L1128, Gauderique Costasesca et al., 'Extrait des registres de la municipalité de Valmagne [sic]', 7 October 1793.
8. For the help of Lucia, see ADPO L1128, Méchain to Lucia [sic], 6 October 1793.
9. Lalande, Pingré, Chabert, Cassini IV and Méchain, 'Rapport', 4 June 1791, in Antoine Albitrecca, *Le plan terrier de la Corse au XVIII<sup>e</sup> siècle* (Paris: Presses Universitaires de France, 1942), p. 74.
10. Méchain, as quoted in Delambre, *Base*, I, p. 430. Delambre notes that the data for this site were recorded in Tranchot's hand: see KM, Delambre, *Base*, I, pp. 429-35. In AOP E2-19 Delambre notes that Méchain supplied Tranchot with correction factors without explaining how or why to use them. Also see Delambre, *Grandeur*, p. 280.
11. For Tranchot's supply of the latitude data of the Spanish forts to the French army, see Henri-Marie-Auguste Berthaut, *Les ingénieurs géographes militaires, 1624-1831: Étude historique* (Paris: Imprimerie du Service Géographique, 1902), I, p. 172. I have not been able to locate the original sources for this claim. Unfortunately, Berthaut almost never cites his sources, and there is something contradictory about the story as he tells it. He says Tranchot got these plans to Dugommier in the year IV, but Dugommier died in the year II; and the plans would not have been any use in the year IV, since the French had already occupied most of these forts and the peace had been signed in the year III. Despite this slip, however, Berthaut was an extremely reliable and knowledgeable historian, who worked exclusively with archival materials from the Dépôt de la Guerre, to which he had complete access for many years. Many of the documents in that holding have since been misplaced. So the gist of his account is likely to be correct, though the timing and manner of the espionage are unclear.
12. For Méchain at Puig Camellas, see Méchain, in Delambre, *Base*, I, pp. 429-45.
13. For Lalande's news of Méchain and Tranchot, see CUS, Lalande to Delambre, 3 frimaire II [23 November 1793].
14. ADPO L1128, Tranchot (at Puig de l'Estelle) to [Lucia], 3 November 1793. Tranchot is quoting from Méchain's letter to him, now lost.
15. ADPO L1128, Tranchot to [Lucia], 3 November 1793.
16. Lucia, in Vidal, *Pyénées-Orientales*, 3, p. 46.
17. For the prohibition against sending data, see AOP E2-19, Méchain to Borda, 10 January 1794. For the orders of Ricardos, see Delambre, *Notice historique sur Méchain*, 18.
18. On Dugommier, see Arthur Chuquet, *Dugommier, 1738-1794* (Paris: Fontemoing, 1904). On the battles of 1793-4, see Joseph-Napoléon Fervel, *Campagnes de la Révolution française dans les Pyénées-Orientales* (Paris: Dumaine, 1861), 2, pp. 210-11.
19. AOP E2-19, Méchain to Borda, 10 January 1794. There are two copies of the letter from Méchain to Borda of 10 January 1794; neither is complete and each contains elements that the other omits: 1) AOP E2-19, Méchain to Borda, 10 January 1794; and 2) ENPC MS1504, Méchain to Borda, 10 January 1794.

20. For the Barcelona measurements, see Méchain's later admission that he was crippled in his right arm and had to operate 'with the help of others' in AOP E2-19, Méchain to Lalande, 4 messidor IV [22 June 1796].
21. For the Mont-Jouy triangulations, see Delambre, *Base*, 1, p. 503. For the weather on 16 March, see *Diario de Barcelona* 77 (18 March 1794), p. 305.
22. For the tensions in Barcelona, see Roua i Aulinas, *Guerra Gran*, p. 75. Herr, *Eighteenth-Century Spain*, pp. 311-12.
23. For Méchain's departure from Barcelona, see BUP MS168.1, Méchain to Slop, 6 September 1794. For the lightning strike, see AOAB Cart. 88, Méchain to Oriani, 2 April 1795.
24. SHAT B4 112, Dugommier to La Unión, 28 prairial II [16 June 1794].
25. SHAT B4 112, Dugommier to La Unión, 15 messidor II [3 July 1794].
26. La Unión to Dugommier [June-July 1794], in J. Delbar, *La comte de La Unión*, *Estudios religiosos* 47 (1889), pp. 235-54; 48 (1889), pp. 57-85, 278-98, 428-50; quotations on 48, p. 287.
27. Delbrel, 'Notes du Conventionel Delbrel', 27 brumaire III [17 November 1794], *Revue de la Révolution* 5 (1885), p. 53.

#### Chapter 5 A Calculating People

1. Charles de Secondat de Montesquieu, *Esprit des lois* [1750], in Montesquieu, *Œuvres complètes* (Paris: Garnier, 1875), 5, pp. 412-13.
2. Marie-Jean-Antoine-Nicolas Caritat de Condorcet, *Observations... sur le vingt-neuvième livre de l'Esprit des lois* [1795], in Condorcet, *Œuvres* (Paris: Didot, 1847), 1, pp. 376-81.
3. For the Committee of Public Safety's pleas to use the new measures, see *RACSP* 9 (30 November 1793), p. 63. For the persistence of the metric diversity into 1794, see AN F12<sup>e</sup> 208, Min. Aff. Etr. to Comité des Subsistances, 30 nivôse II [19 January 1794].
4. Daryl Hafter, 'Measuring Cloth by the Elbow and Thumb: Resistance to Numbers in France of the 1780s', *Cultures of Control*, ed. Miriam Levin (Amsterdam: Harwood, 2000), pp. 69-79.
5. For an example of the regional diversity of anthropometric measures at the end of the *ancien régime*, see Jean-Baptiste Galley, *Le régime féodal dans le pays de Saint-Etienne* (Paris: Imprimerie de la Loire Républicaine, 1927), pp. 315-16, 326. For examples of anthropometric measures hidden behind seemingly abstract units, see Alfred Antoine Gandilhon, ed., *Département du Cher: Cahiers de doléances du bailliage de Bourges* (Bourges: Tardy-Pigelet, 1910), pp. 768, 770.
6. Witold Kula, *Measures and Men*, trans. R. Szreter (Princeton: Princeton University Press, 1986). The word 'anthropometric' can also mean the measurement of the human body; here, following Kula, it is used to denote measures derived from human needs. See also the prescient article by Marc Bloch, 'Le témoignage des mesures agraires', *Annales d'histoire économique et sociale* 6 (1934), pp. 280-2.
7. Galley, *Régime féodal*, p. 282.
8. For a typical claim of how the creation of uniform and abstract units of land area would improve agricultural productivity, see Bureaux de Puy, AP 15 (8 May 1790), p. 440. For the most sophisticated recent treatment of agricultural productivity under the *ancien régime*, see Philip T. Hoffman, *Growth in a Traditional Society: The French Countryside, 1450-1815* (Princeton: Princeton University Press, 1996). This study, for all its quantitative virtues, tells us little about agricultural productivity outside 'modern' farms where records were kept, or about the exchanges which dominated early modern transactions. For a contrasting view, see Jean Peltre, *Recherches métrologiques sur les finages lorrains* (Lille: Atelier Reproduction des Thèses, 1977).
9. Young, *Travels*, 2, p. 44-6.
10. Galley, *Régime féodal*, p. 307.
11. For scientific definitions of 'natural', see Maurice Crosland, 'Nature' and Measurement in Eighteenth-Century France, *Studies on Voltaire and the Eighteenth Century* 87 (1972), pp. 277-309.
12. On the theory of the just price, see Raymond de Roover, 'The Concept of the Just Price: Theory and Economic Policy', *Journal of the History of Economic Thought* 18 (1958), pp. 418-34.
13. For Notre-Dame-de-Lisieux and such practices throughout *ancien régime* Europe, see Kula, *Measures and Men*, pp. 194-5.
14. Charles Porée, ed., *Département de l'Yonne: Cahiers de doléances du Bailliage de Sens* (Auxerre: Imprimerie coopérative ouvrière 'l'Universelle', 1906), pp. 177-8. For the acknowledgment by the official of the role played by metrical diversity, see Robert Vivier, 'Contribution à l'étude des anciennes mesures du département d'Indre-et-Loire', *Revue d'histoire économique et sociale* 14 (1926), pp. 180-99; 16 (1928), pp. 182-227, especially 14, p. 196.
15. On the *ancien régime* economy, see Judith Miller, *Mastering the Market: The State and Grain Trade in Northern France, 1700-1860* (Cambridge: Cambridge University Press, 1999), pp. 34-6. Also see Steven L. Kaplan, *The Bakers of Paris and the Bread Question, 1700-1775* (Durham, NC: Duke University Press, 1996). On the distinction between the market principle and the marketplace, see Steven L. Kaplan, *Provisioning Paris: Merchants and Millers in the Grain and Flour Trade during the Eighteenth Century* (Ithaca: Cornell University Press, 1984), pp. 47-8, 68-9. See also Kula, *Measures and Men*, pp. 71-8.
16. Borda, AP 70 (1 August 1793), pp. 117-18. See also my 'Note on Measures'.
17. Lavoisier, 'Eclaircissements historiques sur les mesures des anciens', n.d., *Œuvres*, 6, p. 703.
18. Condorcet, *Sketch for a Historical Picture of the Progress of the Human Mind*, trans. J. Barraclough (London: Weidenfield & Nicolson, 1955), p. 199. K. M. Baker, 'An Unpublished Essay of Condorcet on Technical Methods of Classification', *Annals of Science* 18 (1962), pp. 99-123; Gilles-Gaston Granger, 'Langage universelle et formalisation des sciences: Un fragment inédit de Condorcet', *Revue d'histoire des sciences* 7 (1954), pp. 197-219. Louis Marquet, 'Condorcet et la création du système métrique décimal', in Condorcet, *mathématicien, économiste, philosophe, homme politique*, eds Pierre Crépel and Christian Gilian (Paris: Minerve,