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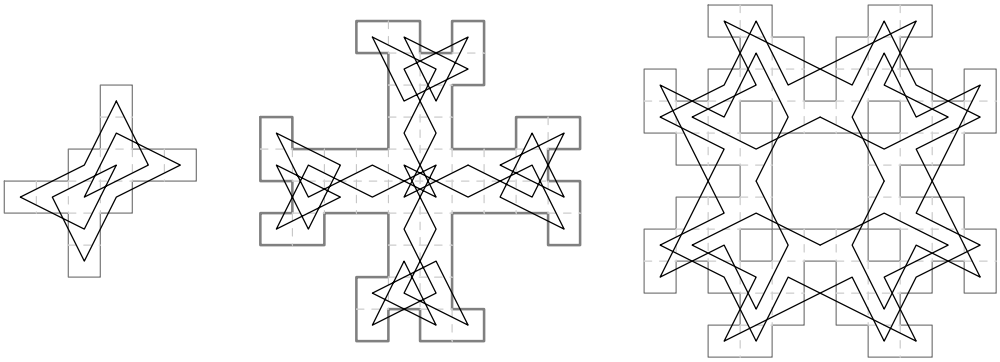
Chronology & Bibliography of Tours



by G. P. Jelliss

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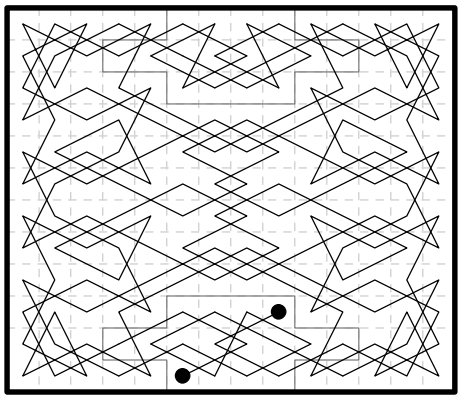

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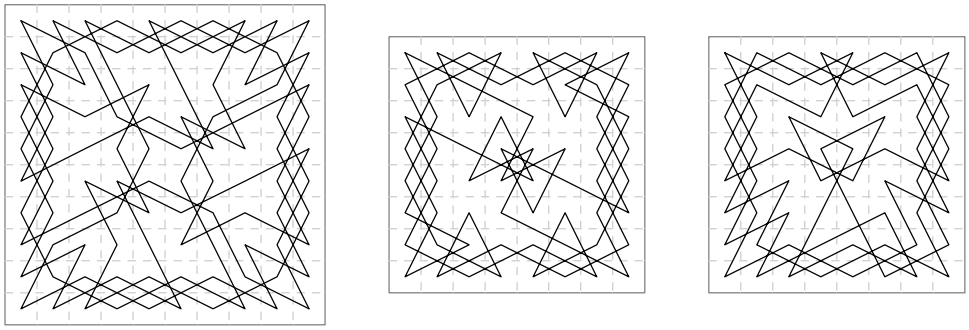

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Title Page Illustrations:

A selection of the author's own work.
Shaped and Holey Board Tours of 6, 44 and 64 cells, showing biaxial and octonary symmetry.
Figured tour with square numbers delineating a cube.
A 12×14 rectangular magic knight tour.
A 10×10 symmetric tour without right angles.
An 8×8 symmetric tour with each angle occurring a multiple of 4 times.
An 8×8 approximately axial tour with no lateral-acute or diagonal-obtuse angles.

Contents

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http://www.mayhematics.com/
Knight's Tour Notes, Volume 12, Chronology & Bibliography of Tours.

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A Concise Chronology

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−3500: Plough used in Mesopotamia. The ploughing of a field is in effect a rook tour.
−2200: Traditional date when the 3×3 magic square was known in China.
−1600 The legendary labyrinth at Knossos, as represented on Minoan coins.
−1000: Wazir paths of Castellar, Maeander and Key types used as border patterns in Greek art.

840~ al-Adli ar Rumi (flourished 840) One closed knight tour survives.
900~ Abu-Bakr Muhammad ben Yahya as Suli (c.880 - 946). Four tours inc.
900~ The *Kavyalankara* by **Rudrata**. Rook, Elephant and Knight tours on 4×8 board.
988: Ben Ishaq An-Nadim. *Kitab al-fihrist*. Bibliography lists books by al-Adli and as-Suli.

1069: Nami of Guzerat. Commentary on Rudrata (c. 900) *Kavyalankara*.
1141: al Baghdadi ms with extracts from al-Adli, as-Suli has the four as-Suli tours.
1150~ *Manasollasa* of King Somesvara III, Kalyani, India. Tour described by two-letter coordinates.
1221: Muhammad ben Hawa ben Othman. Ms with 2nd as-Suli tour. [Murray 1913, p.174-5].
1250 Collections of chess problems ascribed to **'Bonus Socius'** meaning Good Companion.
1257 Arabic ms in the British Museum. Problems with capture of series of pawns by knight.
1275~: The King's Library ms. Anglo-Norman. Halfboard and double halfboard tours.
1315: Manuel Moschopoulos work on magic squares using the step-sidestep method.
1325~: Nicolas de Nicolai. Latin ms. Sets halfboard tour problem with six solutions.
1330~: al Hakim ms has the tours attributed to al-Adli and Ali ibn Mani.
1350 Later collections ascribed to '**Civis Bononiae**' meaning 'Citizen of Bologna'.
1350~: al Amuli (d. 1352). Persian *Treasury of the Sciences*. Contains a corner-to-corner tour.
1370~: — Cairo ms in Khedival Library, with three of the tours given by Baghdadi 1141.
1400~: Ala'addin Tabrizi 16th century ms asks for quarterboard tour.
1490~: Florence. Italian ms (codex XXIV) has a 4×8 tour.

1511: Johannes Chachi, of Terni. Ms collection of chess problems, includes a 4×8 tour.
1512: Paulo Guarini di Forli. Ms in the J. G. White collection contains the Civis Bononiae tour.
1597: Orazio Gianutio della Mantia. This has one 4×8 tour.

1612: Claude Gaspar Bachet *Problemes Plaisans et Delectables*, 1612. No tours.
1637: René Descartes (1596-1650) *Discours de la méthode*, (1637). Use of numerical coordinates.
1640: Bhatta Nilakant-ha *Bhagavantabhaskara* One tour fully symmetric
1660: Bernard Frénicle de Bessy (c.1605-1675) Catalogue of 880 diamagic squares 4×4.
1694: Jacques Ozanam (1640-1717) *Recreations Mathematiques et Physiques* First edition 1694.

1725: Pierre Rémond de Montmort (1678-1719) Open tour in Ozanam.
1725: Abraham de Moivre (1666-1754) Open tour in Ozanam (with alternative version in text).
1725: Jean-Jacques d'Ortous de Mairan (1678-1771). Open tour in Ozanam.
1736: Leonhard Euler (1707-1783). Solutio problematis ad geometriam situs pertinentis 1741.
1737: Philip Stamma (c.1705-c.1755) *Essai sur le Jeu des Echecs* Algebraic chess notation.

1751: Denis Diderot (1713-1784) Main editor of the *Encyclopédie* .
1751: Jean le Rond d'Alembert (1717-1783) *Encyclopédie* art. *Echecs* in Vol.5 p.244-248.
1753: William Hogarth (1696-1764) *The Analysis of Beauty* (1753) Serpentine 'line of beauty'.
1757: Leonhard Euler (1707-1783) Knight's tour in letter to Christian Goldbach (1690-1764).
1759: Leonhard Euler (1707-1783) 'Solution d'une Question ...' Paper on Knight tours. 1766.

1766: Lelio dalla Volpe *Corsa del Cavallo* ...First to show knight's tours in diagram form.

1767: (Monsieur) B—: Letter to the editors of the *Journal Encyclopédique* re knight's tours.
1769: Farkas Kempelen (1734–1804) inventor of the first chess-playing 'automaton'.
1769: Edmé Gilles Guyot *Nouvelles Récréations ...* Similar to Ozanam with Moivre tour.
1769: Domenico Lorenzo Ponziani (1719-1796) *Il Giuoco Incomparabile...* quotes Ozanam.

1771: Alexandre-Théophile Vandermonde (1735-1796). One 8×8 tour joining 16-move circuits.
1772: Edmé Gilles Guyot. *Neue physikalische ....* German edition of Guyot (1769).
1772: Cosimo Alessandro Collini (1727-1806) articles in *Journal Encyclopédique* with one tour.
1773: Collini *Solution du Problème du Cavalier au Jeu des Echecs* 20 tours.
1773: A. C. B—. in *Journal Encyclopédique* complaint that in Collini tour knight starts from B1.
1773: (Le Chevalier) W— 'Capitaine au régiment de Kinski'*Journal Encyclopédique* closed tour.
1774: Collini Soluzione del problema... *Magazzino Toscano* Italian edition of his work,
1776: (Jean Louis?) Monneron or one of his brothers sends two tours to *Nouveau Dictionaire*.
1778 Louis Bertrand of Geneva. Work on Mathematics, but does not mention his ideas for Euler.

1780: Gaspard Monge (1746-1818). Pages of symmetric tour found among his papers recently.
1780: Chapais: *Essais analytiques sur les Echecs*. Ten tours of Collini type, four on larger boards.
1782: Laisement (1729-1800) *Essai sur les Problèmes de Situation* Many tours inc 16x16.
1783: Windisch Eye-witness account of how knight's tour was exhibited by Kempelen automaton.
1787: Richard Twiss *Chess* (two volumes 1787 and 1789). First tour on a circular board.
1789: Giorgio Fontana, *Opuscoli Matematici ...* Euler.

1790: J. E. Montucla, revised edition of Ozanam. Adds the Chevalier W. (1773) tour.
1791: (Fr.) Wilhelm A— of Cleve, ms *Der Rössel-Sprung* ...in Lasa collection. One tour.
1797: Ernst von Sachsen-Gotha *Reichs-Anzeiger* and *Auflösung ...* ms Figured tours.
1798: Shir Muhammad-Khan, *Sardarnama*, Persian ms. Contains the Nilakant-ha tour.

1800: Lalande: and **Bossut** *Dizionario Enciclopedico delle Matematice*. Euler's method.
1803: Charles Hutton *Recreations in Mathematics ...*, 1803, 1814. English editions of Ozanam.
1804: Maelzel Exhibited Kempelen's chessplaying automaton in England and N. America.
1804: (Rev.) Thomas Pruen, *An Introduction to the History and Study of Chess*. Moivre tour.
1806: Joseph Dollinger, *Ein Hundert ... End-Spiele. Dann ... Arten den Springer...* 24 tours.

1811: (Prof.) Vicenzo Brunacci *Compendio del Calcolo Sublime*. After Euler 1759.
1814: Charles Hutton *Recreations in Mathematics ...*, new edition of Hutton (1803).
1815: 'Promenade des Springers' *Thee und caffee-Zeitvertreib*, 2 Jan 1815.
1816: Mollweide *Dissertationis Mathematicae de Quadratis Magicis Pars Prior*'
1817: Babbage 'An Account of Euler's Method ...' *J. Science and the Arts* Royal Institution.
1817: Teofrasto Cerchi editor *Giuochi Fisici e Matematici ...* Italian edition of Guyot (1769).

1820: Pierce Egan *Sporting Anecdotes ...* London 1820 (and Philadelphia 1822). 4-star tour.
1820: Bingham, editor. Another English edition of Ozanam (1790).
1820: Grandin Editor of French editions of Ozanam's *Recreations* 1820, 1825, 1835.
1821: S. Kenny *Schachgrammatik* translated by Baumgartner, Leipzig. [Cited by Müllner 1825]
1821: Robert Willis *Attempt to Analyze the Automaton Chess Player ...* 18 small and 20 tours 8x8.
1821: *The Edinburgh Philosophical Journal*. Review of Willis with two smallboard tours.
1823: *The Edinburgh Philosophical Journal* . Further review of Willis with 20 chessboard tours.
1823: *The Youth's Miscellany of Knowledge and Entertainment* .
1823: C. B. Mollweide 'Uber das Problem des Rösselsprungs' *Math. Wörterbuch* art: Springer.
1823: *Nouvelle Notation*, 9 tours, one from Monneron 1776.
1823: H. C. von Warnsdorf *Des Rösselsprunges einfachste und allgemeinste Lösung* 96 Figures.
1824: *Easy Introduction ...* to chess. (Philadelphia 1824). The Moivre tour.

1824: von Müllner in *Literatur-Blatt* #39 and #40. History and Review of Warnsdorf.

1825: von Müllner in *Allgemeiner Lit. Zeitung* History and Review of Warnsdorf.
1825: F. P. H— Appendix to *Studies of Chess* Three new tours two of squares and diamonds type.
1826: C. R. R. von Schinnern: *Ein Dutzend mathematischer Betrachtungen* S&D Tours.
1827: Giuseppe Ciccolini. *Il Nuovo Tesoro degli Scacchi* Rome 1827. 4 tours reported none found. -
1827: *The Franklin Journal and American Mechanics' Magazine* Moivre and Chevalier W. tours.
1827: F. W. von Mauvillon *Anweisung zur Erlernung des Schachspiels ...*With 5 tours.
1828: J. de Quack Dutch version of Mauvillon, but may not contain the tours.
1829: Hirsch Silberschmidt *Das Gambit*. (1829) A compartmental tour.

1830: A. M. Legendre *Théorie des Nombres*. Euler's method with 5 new asymmetric closed tours.
1831: E. Billig *Der Rösselsprung mit Variationen*. One tour 64 times according to Murray.
1832: George Walker *A New Treatise on Chess* Advocates Warnsdorf's rule
1832: W. Hone *Year Book of Daily Recreations and Information* 5 tours by 'W' (prob. Walker).
1834: Ignaz Plödtiels. *Versuch einer allgemeinen Lösung des Rösserlsprunges ...* ms
1834: 'Das Schachspiel' *Der Pfennig-magazin der Gessellschaft*

1836: Teodoro Ciccolini *Del Cavallo degli Scacchi* One S&D tour. Others by Euler's method.
1836: Giuseppe Gasbarri *Raccolta di Venticinque Nuovi Problemi di Scacchi* …, one tour.
1837: G. A. Addison'General Solution to the Knight's Trick at Chess' One tour.
1838: C. W. Zuckermandel *Regeln ... Anweisung den Rösselsprung*. S&D method with 112 tours.
1838: (Dr) S. Weir Mitchell. One of the owners of Kempelen automaton destroyed by fire in 1854.
1839: H. F. Massmann *Geschichte des mittelalterlichen ... Schachspiels*.Bibliography.
1839: J. E. Thomas de Lavernède 'Problème de Situation' S&D tours between any two cells.

1840: Edward Riddle *Recreations in Science and Natural Philosophy* after Hutton and Ozanam.
1840: George Walker'Chess without a Chessboard' *Fraser's Magazine*. Mnemonic method.
1840: George Walker 'On moving the Knight over every Square ...' *Phil Mag* Bibliography..
1840: P. M. Roget 'Description of a Method ... ' *Phil Mag*. LEAP method of nets.
1841: George Walker *Polytechnical Journal*.
1841: (Prof.) C. F. H. A. Glaszer. 'Abhandlung über ...Springers ...', Tour by **Prof. Rothe**.
1841: Charles Tomlinson 'The Knight's Tour' *Saturday Magazine*, cited in Tomlinson (1845).
1842: L. Perenyi. *Mnemonik des schachspieles ...* Gianutio (1597) tour joined to a copy of itself.
1842: G. Libri 'Mémoire sur l'emploi des fonctions discontinues ...' Mentions knight's tour work.
1842: Victor Käfer 'Vom Rosselsprunge' 40 diagrams, 25 complete tours, all in geometric form.
1842: E. T. Troupenas 'Problème du Cavalier ...' *Le Palamède* Three new S&D tours etc.
1842: Jules de Poilly 'Une des Marches du Cavalier aux Echecs' *Le Palamède* Cryptotour.
1843: (Lieut.) Paul Rudolph von Bilguer *Handbuch des Schachspiels* Three irregular tours.
1843: (Rev.) R. Moon 'On the Knight's Move at Chess' *Cambridge Math J*, Annular method.
1844: Jules de Poilly 'Une des Marches du Cavalier aux Echecs' *Le Palamède* Cryptotour.
1844: George Walker *Chess Player`s Chronicle* About a Persian manuscript.
1844: F. J. Brede *Almanach für Freunde vom Schachspiel* 24 symmetric tours in diagram form.
1844: J. B. A. Charpentier, *Du Jeu des Echecs a la Portee des Jeunes Gens* …, tours from Käfer

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1845: *Leipziger Illustrirte Zeitung* #111 cryptotour, possibly the first German example.
1845: Charles Tomlinson *Amusements in Chess*. Assorted tours.
1846: Jules de Poilly 'Une des Marches du Cavalier aux Echecs' *Le Palamède* Cryptotour.
1846: T. von der Lasa 'Lösung des Rösselsprung' *Schachzeitung*. Collini, method of quartes etc.
1846: Aaron Alexandre *Collection des plus beaux Problèmes d`Echecs*. Troupénas tours.
1847: Ferdinand Minding. *Bulletin de l'Academie des Sciences de St Petersbourg*
1847: R. Franz, 'Rösselsprung', *Schachzeitung*, Closed asymmetric tours of S&D

1848: Dr Carl Rädell 'Uber die mathematische Behandlung des Schachspiels'. No tours.
1848: 'De oplossing van den paardensprong' *Sissa* Euler, Warnsdorf, Cryptotour.
1848: William Beverley 'On the Magic Square of the Knight's March' *Phil Mag*. First magic KT.
1849: Staeker lost ms. 2 near axial tours, 5 tours on a 128-cell four-handed chess board.
1849: Otto von Oppen 'William Beverley's Rösselsprung', *Schachzeitung*, vol. 4, p.21–24. [A]
1849: P. H. Fuss and **N. Fuss** (editors), *Leonhardi Euleri Commentationes Arithmeticae Colectae*.
1849: A. Herma, *Rösselsprünge aus deutschen Dichtern*: *Auflösungen*. Cryptotours. (1889?)
1849: Carl Wenzelides 'Bemerkungen uber den Rosselsprung' *Schachzeitung* 72 figures
1849: Carl Wenzelides 'Der Rösselsprung in höchster Kunstvollendung' First closed magic KT.
1849 Wilhelm Hanstein A poetic encomium celebrating the symmetric magic KT.
1849: E. A. Schmitt 'Paardensprong-raadsel' {Knight's tour enigma} *Sissa* Cryptotour.
1849: A. F. Svanberg. *Schachzeitung* mentions magic tours by this Swedish Professor now lost.
1849: Q. Poirson-Prugneaux. *Introduction Pratique du Jeu des Echecs*. 13 tours, none new.
1849: J. B. A. Charpentier *Anciens et Nouveaux Jeux Géométriques, …,* A near axial tour.

1850~: A modern Turkish manuscript of chess problems in the J. G. White Collection 4 tours:
1850~: W. Manning, ms, *The Knight`s Tour*, in the von der Lasa library, no date. [L]
1850~: Elias Stein *Manuel de l'Amateur de Jeu des Echecs...* Euler tours and Moivre tour.
1850: Carl Wenzelides 'Bemerkungen uber den Rosselsprung' *Schachzeitung* 42 figures, 2 magic.
1850: — 'De oplossing van den paardensprung', *Sissa*, p.144. [L]
1850: Paolo Volpicelli 'Solution d'un Problème de Situation ...' *CR de l'Acad. Sci.* No tours.
1850: T. Scheidius 'Het Problema van den Paardensprong' *Sissa* S&D tours.
1851: Carl Wenzelides 'Uber symmetrische Rösselsprünge', *Schachzeitung* 19 paras, no diagrams.
1852: Ferdinand Minding.'Uber den Umlauf des Springers ...' *Crelle's Journal*. Same as 1847.
1852: Ferdinand Minding *Cambridge and Dublin Math. Journal*. English version.
1852: A. H. E. Lamarle 'Solution d'un coup singulier' *Mém de l'Acad Royale Belgique*.
1852: *Illustrierte Zeitung* cryptotours on the Four Handed Chess board, cuttings [C]
1852: Rajah of Mysore, Krishnaraja Wodeyar silk printed with a magic tour.
1852: *Nouvelles Annales de Mathématiques* 'Sur le Problème du Cavalier ... Cites Legendre.
1853: Barthelemy de Basterot *Traité elementaire du jeu des echecs* after Tomlinson (1845).
1853: Dr T. Clausen, 'Direkte Auflösung des Rösselsprung', *Archiv der Math und Phys*. [C]
1853: Anselm T. Quignano, *Saltos del caballo; Problema de Ajedres*. [C]
1853: 'De oplossing van den paardensprung', *Sissa*, p.39, 69, 89, 102, 138 [L]
1854: George Allen. Acquired from Dr Mitchell a tour template used in the automaton.

1855: Arnold Pongracz 'Rosselsprunge' *Wiener Schach-Zeitung* Symmetric closed tour (hk type).
1856: Edmond Slyvons *Application de l'Analyse aux Sauts du Cavalier ...* Tour with Greek Cross.
1856: Max Lange 'Die Lehre vom Rosselsprung' *Lehrbuch des Schachspiels*. Guarini, Wenzelides. .
1856: Durand 'Géneralisation Complète du Problème d`Euler' *La Régence* (1856) no diagrams.
1856: W. R. Hamilton Letter to J. T. Graves (17 Oct 1856) on dodecahedron tour game.
1857: W. R. Hamilton 'On the Icosian Calculus' *British Association Report*. Formal treatment.
1857: N. F. Leonhardt *Handbuch fur angehende Schachspieler ...* (Altona 1857) p.149–155. [C]
1858: Otto von Oppen 'Rösselsprung' *Schachzeitung* three magic tours by Wenzelides
1858: H. C. von Warnsdorf 'Zur Theorie des Rösselsprungs' *Schachzeitung* 8×8 6×7 5×6 tours.
1859: C. F. A. Jaenisch *Chess Monthly* Articles in French and English. Two new magic KT.
1859: G. Mann (Jr) *120 neue Rösselsprunge ohne nebst einer kurzen Einleitung* in graphic form.
1859: Charles Knight *English Cyclopaedia, Arts and Sciences* after Tomlinson 1845.

1860: Duncan Forbes His *History of Chess* has a translation of 1400 quarterboard problem.
1860: 'Moving the Knight over all the Squares...' *Boy's Own Conjuring Book* after Walker (1840).
1860: (Monsieur) Lamouroux 'Probleme de deux Cavaliers...' *Nouvelle Regence*. Pseudotour.
1861: E. P. de Chambure 'Séance du 5 Mars 1861' *Bulletin de l`Institut Egyptien*.

1861: Camille de Polignac *CR de l'Académie des Sciences* 'Sur la Course du Cavalier...' [A][C].
1861: *Cosmos: Revue Encyclopédique Hebdomadaire* A review of Polignac. [C]
1862: Durand 1856 repeated with two chess diagrams in *La Nouvelle Régence* no tours.
1862: E. P. de Chambure 'Du Problème Relatif ...' *Mémoires a l`Institut Egyptien* Roget reinvented.
1862: C. F. A. Jaenisch *Traité des ... Mathématique au Jeu des Echecs,* Four new magic KT.
1862: T. von der Lasa *Schachzeitung*. Review of Jaenisch 1862.[A]
1863: C. F. G. Thon; *Thon's Meister im Schachspiel*..., edited by Max Lange. [C]
1863: F..A..A. Mercklein 'Marche du Cavalier ...' *Memoirs de la Soc Imp ... à Douai*. One tour.
1863: Carl Rädell *Mathematische Schachfragen*.
1864: *Nuova Enciclopedia Populare Italiana* 5th edn (Torino vol.20 1864) p.629. (Euler). [L]
1864: S. S. Haldeman. *Prodromus: Bibliography of the Chess Knight's Tour* [C]
1864: S. S. Haldeman. *Tours of a Chess Knight* Collection of 108 tours on 8×8 and 3×8 5×6 tours.
1864: J. H. Alexander in Haldeman A S&D and Rogetian tour.
1864: George Allen chess library including a knight's tour template from Kempelen automaton.

1865: C. Tychsen *Tidskrift för Mathematik* series 2 (vol.1 1865) p.17-20. [C]
1865: A. C. Crétaine *Etudes sur le Problème de la Marche du Cavalier...* Over 100 tours.
1865: B. H. Braadbaart Two ms *De Paardensprung in het Schaakspel* ... [C] [K4083/4]
1865: A. Geynet 'Mémoire Relatif au Problème du Cavalier' *CR de l`Académie des Sciences*. [M]
1865: Serge de Stchoulepnikoff *Twenty solutions of the Problem of the Knight's Tour* [C]
1866: *Globe, De; Album van Buitenlandsche Lettervruchten*, 'Merkwaardigheden ...schaakspel' [C]
1866: *Sphinx*, *Le* 1866, p.67, an account of Mercklein (1863). [L].
1867: Carle Adam (le Jeune) *Le Kaleidoscope Echiquiéen* ... With 2492 tours and pseudotours.
1867: Sam Loyd 'The Queen's Tour' *Le Sphinx*. [A. C. White 1913] 14-move cross-over path.
1867: *Passatempo*, *Il*, [C] One near-biaxial tour shown in geometrical form:
1867: A. Canel *Recherches sur les jeux d`esprit* ... Contains a cryptotour.
1868: E. B. Cook (and other editors). *American Chess Nuts* Gives the Loyd (1867) queen tour.
1868: Ernest Nivernais 'La Bibliothèque de M Adam' *Strategie*. Review of Adam (1867). [L]
1869: *Westminster Papers* 'The Tour of the Knight' an account of Roget (1840). [L]

1870: Howard Staunton *Illustrated London News* 16 cryptotours, attracting many solvers.
1870: Antonius van der Linde *Schachlitteratur, Bibliographische* [Cited by Meyer 1873]
1870: W. H. Browne. 'Dictation Tours of the Chess Knight' *New Eclectic Magazine*, Roget method.
1870: Charles van Tenac *Traités Illustrés des Jeux des Echecs ...* . [C]
1870: *An Arm-Chair in the Smoking Room ... from various pens*. [C]
1871: 'De Leer van den Paardensprung' *Sissa* after Max Lange (1856). [L]
1871: Victor Gorgias Frontispiece of *Westminster Papers*. 160 cell open tour on four-player board:
1871: Victor Gorgias 'The Knight's Tour' *Gentleman's Journal* in column by H. Meyer.
1871: Victor Gorgias *Dubuque Chess Journal*, several issues. Near biaxial tours 8×12 board.
1871: Harikrishna Sharma. *Kridakausalyam* ms. 76 tours by Rajah of Mysore.
1871: Rajah of Nysore in Harikrishna ms includes magic 12×12 tour, figured tours etc..
1872: Paolo Volpicelli 'Soluzione Completa ... *Atti della Reale Academia de Lincei* Rome
1872: Paolo Volpicelli 'Solution Complète ...' *CR de l'Académie des Sciences* Paris
1872: H. Tarry 'Solution du Problème du Cavalier...' *Les Mondes* Review of Volpicelli 1872
1872: Edmé Simonot *Le Polygraphile décrit par son inventeur* ....bibliography
1872: Edmé Simonot *La Strategie* Summary of the above. Review of Adam (1867).
1872: Heinrich Meyer *English Mechanic and World of Science*. Aug 1872. Vandermonde's tour.
1873: J. B. D— 'The Knight's Tour' *The Leisure Hour* ...cryptotour tours from the H pseudotour.
1873: Heinrich Meyer 'The Knight's Tour' *The Leisure Hour* number of 8×8 tours by end cells.
1873: E. H— *Glasgow Weekly Herald*. A series of 'Knightly Peripatetics'
1873: 'J. R—' 'Eine Rösselsprungs-Frage' *Deutsche Schachzeitung* (vol.28 1873) p.283. [A]
1873: A. Régnier 'Problème de la Marche du Cavalier' *Les Mondes* (vol.32 1873 p.507-14). [A]

1873: A. Weber *Monatsbericht der Königlichen Akad...* (Berlin) Nilakant-ha tour.
1874: Antonius van der Linde *Geschichte und Litteratur des Schachspiels*
1874: Paolo Volpicelli 'Réponse aux Critiques faites a ma Solution ...' *Les Mondes*. [A]
1874: A. F. Stenzler 'Uber Nilakant-ha's Rösselsprung' *Monatsbericht der König Akad* (Berlin). [C]
1874: Antonius van der Linde *Geschichte und Litteratur des Schachspiels* bibliography.
1874: Count Ligondès, aka 'Palamède'. *Polygraphie du Cavalier*, Orleans, 1874 [M].

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Bibliography

Full names of authors, together with biographical details, where known and felt to be relevant, are given, followed by titles of their books or articles in journals. Data on birth and death are given in the sequence: Year, Month, Day, Place. Names are listed in strict alphabetical order. Surnames preceded by prefixes are listed under the main part name (e.g. van der Linde as Linde).

Publication details are mostly presented in the sequence: *Journal* volume year issue month pages 'Subject'. Punctuation in references is minimal. Volume numbers are shown in arabic numerals (1, 2, 3, ...), even if in roman on the actual volume. Some of my sources of information are shown in square brackets at the end of the entry. References cited in the bibliographies by van der Linde 1874, Ahrens 1901 and Murray 1930 or 1942 are marked [L], [A] and [M]. Library locations, including shelf-marks or catalogue references, are indicated, where known, for assistance of researchers.

Abbreviations used for the main libraries are: [B] British Library (includes the Science Reference Library, and the India Office Collection, which are, or were, in separate locations), [C] Cleveland Public Library, Ohio, USA (includes the J. G. White collection), [K] Koninklijke Bibliotheek, The Hague, Netherlands (includes the van der Linde and Niemeijer chess collections), [LU] Leicester University Library (includes the Mathematical Association collection), [O] Oxford University Library (includes the Bodleian Library and the Radcliffe Science Library and the Murray collection).

Titles are increasingly becoming available on the internet (e.g. in Google Books), but since the addresses are long or liable to change the reader is referred to the Knights Tour Notes web pages [http://www.mayhematics.com/t] for up to date links.

Abbreviations: c circa, ms manuscript, vol volume, ser series, p pages, months are reduced to three letters (Jan to Dec). Signs: ¶ problem, # issue, — missing information.

A

A—, (Fr) Wilhelm (of Cleve): ms *Der Rössel-Sprung durch alle 64 Felder des Schachbrettes* Cleve 1791. Not seen by me. Was in Library of von der Lasa. One tour according to Murray (1930).

A— of Orleans, (Mme) Diane. Pictorial and Compartmental Tours in *Le Siécle* 1878.

Aaron, Manuel: See *Indian Chess History* (2013)

Adam (Le Jeune), Carle *Le Kaleidoscope Echiquiéen. Traité Complet de la Marche du Cavalier sur les Echiquiers de 25, 36, 64, 100, 144 et 256 Cases* (Rouen, 1867). With 2492 tours and pseudotours in 18 categories. This work is in the J. G. White collection at Cleveland Public Library Ohio USA. It is bound in two volumes, with printed title pages, but I have only seen scans of part of this work. Two pages consist of a handwritten letter in English dated 1909 from C. Gerfand Proti, the previous owner of the ms, presenting it to the White collection. Eight pages reproduce a review article by Edme Simonot from *La Strategy, Journal D'Echecs* 1872 which summarise the contents of the 18 'serie' into which the work is divided. The text is in a very clear hand writing (one could almost think it was printed) and the diagrams are very precisely drawn, using coloured lines on green-printed chequered boards with printed headings. A very attractive production. The tours are in rather repetitive groups. Series 9 shows 24 tours on the 5×5 board, including the 8 symmetric cases (two duplicated) and the 6 cases with ends a fers move apart, and examples of 3 of the other 6 cases of end-point separation. Series 8 on tours of the 6×6 board, includes 4 of the 5 tours with quatersymmetry, and 14 of the 17 with binary symmetry. So the claim to be 'complete' is not fully justified. I would like to have seen more of the diagrams.

Adamson, Henry Anthony (1871 Jan 21. Ealing - 1941 Aug 21 Falmouth) *Chess Amateur* 1923, in 'The Problem of the Knight's Tour'. §24 continued. Refines the method of F. Douglas to estimate the number of 8×8 tours finding: (2^22)(3^24)(5^8)(7^6)×2. *Problemist Fairy Chess Supplement* (vol.1 #11 Apr 1932 p.64) ¶376 A Dawsonian figured tour, octagon shaped path.

Addison, George Augustus (1792–1814) 'General Solution to the Knight's Trick at Chess' *Indian Reminiscences* or The Bengal Moefussal Miscellany (Edward Bull, London 1837, p.19-27). [M] [Archive.org, online] The introduction to the *Miscellany* (which may have first been published as a periodical magazine) gives a brief biography of Addison who, though born in Calcutta, was like many civil servants of the East India Company, educated at Newcome's School in Hackney, London. He became Secretary to Stamford Raffles who was at that time Governor of Java, but he died at the age of only 22 from a tropical fever.

Adli ar Rumi, al- (flourished 840) *Kitab ash-Shatranj* {Book of Chess}. Earliest dated tour.

Adsum; pen name of Charles Bouvier.

Ahrens, Wilhelm Ernst Martin Georg (1872–1927); *Encyk. Math. Wiss* (Teubner Leipzig 1900 vol.1 part 2 section IG1 p.1080-93) 'Mathematische Spiele' Bibliography, enumerations, magic tours [Singmaster 1987]. *Mathematische Unterhaltungen und Spiele* (Teubner Leipzig 1901 Ch.11 p.165-208) 'Der Rösselsprung' §1 Knight's move §2 Guarini's problem §3 Euler's method §4 Warnsdorf §5 Small boards and Euler's crosses §6 Minding algebraic approach §7 Collini and borders §8 Vandermonde §9 Squares and Diamonds and Roget, misattributed to Ciccolini §10 Frost's compartmental method §11 Magic tours, one example (Jaenisch 12o) §12 Cubic tours 4×4×4 by H. Schubert §13 Number of tours: Sainte-Marie's results on 4×8 §14 Rook non-intersecting paths. [LU] [K4104] 1910 edition: Use of knight's tours as a secret code p.325 [Singmaster]. 1918 edition: Pandiagonale magische Quadrate p.40-41 [Bidev 1986].

Akenhead, (Major) J. *British Chess Magazine* (1945 vol.65 p.309, sol 1946 vol.66 p.66) ¶6920 Divide the 8×8 board into four 4×4 quarters by lines. Play a knight tour which crosses these lines only at a4-c5, b4-d5, d8-e6, d7-e5, h5-f4, g5-e4, e1-d3, e2-d4. This is the first example of a problem to construct a tour with given slants. "H. J. R. Murray has sent a complete analysis proving there are 1024 tours in all of the kind required and has given the elements to draw them all." *Fairy Chess Review* (1949 Jun p.4, sol Aug p.53) ¶8146 A tour with 12 slants solving the problem of constructing a tour to show the nine fundamentally different slants, and a minimum number of extra slants. He also reported a sighting of the magic square silk of the Rajah of Mysore, in a letter dated 12 March 1947 to *Fairy Chess Review* (vol.6 #11 Apr 1947 p.84).

Ala'addin Tabrizi: (aka Ali ash Shatranji, c.1400). Royal Asiatic Society ms. Quarter tour puzzle.

Alban pen name of Will Scotland *Crossword* the magazine of The Crossword Club 1988. Uses a 10×10 knight's quaternary tour and the first verse of Lewis Carroll's *Jabberwocky* (which happens to have 100 letters) to make a crossword puzzle.

Albert, Eugene (b. 1930 Jan 9) *Scripta Mathematica* (vol.27 #2 1962 p185-7) 'Generalized symmetric random walks'. The probability of a piece being on a particular square after a long random walk is proportional to its mobility there. [Offprint from the author]

Alcuin (735 York - 804 Tours), also known as Ealhwine, or Flaccus Albinus. According to the Laings (1992) the seal on the Book of Kells (~800) illustrates a saying from Alcuin.

Alembert, Jean le Rond d' (1717-1783): See *Encyclopédie* 1751.

Alexander, John Henry (1812-1867) of Baltimore, a railway Engineer and surveyor. Haldeman (see entry below) includes a squares and diamonds (and Rogetian) tour said to have been constructed by Alexander for George Allen (1808-1876) though he gives no date or reason for this.

Alexandre, Aaron: *Collection des plus beaux Problèmes d`Echecs*, Paris 1846. An influential collection of chess problems, published simultaneously in French, German and English editions: The English title being: *Beauties of Chess*, London. The German title: *Praktische Sammlung bester Schachspiel-Probleme*, Leipzig. (Olms reprint, Zurich 1979, Problems p.341, Solutions p.63.) The two squares and diamonds tours by Troupénas (1842) were given wider circulation in this work. [Copies from J. D. Beasley and S. Pantazis]

Ali ash Shatranji; see Ala'addin.

Allen, George (1808-76) owner of a chess library, later acquired by the Library Company of Philadelphia, including a knight's tour template from Kempelen's automaton. See also Alexander.

Amuli, Muhammad ben Mahmud, al- (died 1352): Persian *Treasury of the Sciences* has three chapters on chess and survives in numerous manuscript copies of variable quality. The tour is from one corner to an adjacent corner. [Murray 1913 p.177 description; 1930 p.4 tour diagram].

Anderson, —: contributor of squares and diamonds tour to Troupenas 1842; (very conjecturally John Henry Anderson, the 'Wizard of the North', 1815-1874).

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ApSimon, Hugh: *Mathematical Gazette* (Feb 1956 p.52). Mathematical Notes 2592 'Knight's rotationally symmetric re-entrant tour'. [*MG* Index online] See W. H. Cozens.

Arm-Chair in the Smoking Room, An *... from various pens* (S. Rivers & Co, London 1870, title page and p.78-81). [C] Not seen by me.

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B

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B—, Monsieur: Letter to the editors of the *Journal Encyclopédique* enquired about knight's tours and the editors responded with a review of Euler's paper, quoting his first two tours, Tome 1, Part 3, Feb 1767, p.124–128.

B—, A. C. writing from Pont-à-Mousson, 17 Jan 1773, 'Observation sur la solution d`un problème relatif au jeu des échecs', *Journal Encyclopédique*, vol.2 Feb 1773 p133-135. His main complaint seems to be that in Collini's example tour the knight starts from the bishop square!

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Babu, Lala Raja (Sahib) *Mo'allim ul Shatranj* 1901. 27 tours. (1-10) The first one is the Moivre tour with middle three moves reflected. The next nine are similar, the eighth incorporating a central 3×4 tour, the last two closed. (11) Euler's first symmetric bipartite tour. (12-17) Three open and three closed tours omitting various squares. (18–21) Four tours with approximate symmetry. (22–26) Open tours 7×8, 6×8, 5×8, 4×8, 3×8. (27) Open 10×10 tour joining four 5×5 tours. [Murray 1930]

Baghdadi, Abu Ishaq Ibrahim ben al-Mubarak ben Ali al-Mudhahhab, al-; 1141, manuscript #560 in Istanbul Library, title *Kitab ash-shatranj mimma's-lafahu'l-Adli was-Suli wa ghair-huma* {Book of chess: extracts from the works of al-Adli, as-Suli and others}. This has the four Suli tours. [Murray 1913, p.171-2]

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Bastian, Herbert 'Die geheim Leidenschaft des Gaspard Monge' *Schach* Oct 2017 p.32-43. Finds 13 tours by Gaspard Monge (1780) in Paris. He also argues that Monge is the author of the Chapais (1780) manuscript.

Beasley, John Derek (1940 Feb -)

Variant Chess #31 'Circular Chess in Lincoln' p.33-34 and 48, #32, includes tours after Twiss (1789) p.55; #55 Sep 2007 'A remarkable magic knight's tour in three dimensions' p.8; #56 Feb 2008 'Latin Cube Magic Tours' p.32; #57 May 2008 'Another Look at 8×8 Magic Knight's Tours' p.50-53 (includes a complete catalogue of the 140 magic tours and historical details); #58 Oct 2008 'Torus Tours' p.60; #61 Jul 2009 'Grasshopper Tours' p.115 (a review of Kotesovec); #62 Oct 2009 'Complementary five-leaper tours' p.131; #64 Aug 2010 'Complementary five-leaper (and other) tours with rotational symmetry' p.232-233;

The College Mathematical Journal 'Magic Knight's Tours' vol.43 #1 Jan 2012 p.72-75.

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Beluhov, Nikolai (1990 Jan 19 -) arXiv:1310.3450 On Crosspatch Knight's Tours (2013). arXiv:1708.05810 A Proof of Willcocks's Conjecture (2017).

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Bennett, E.W. [No biographic details]. *Fairy Chess Review* (vol6 #10 Feb 1947 p.72, sol #11 Apr 1947 p.82) ¶7159 Proposed: "To construct a knight's tour so that the join of the mid-point of the board to the moving knight always rotates in the positive direction (anticlockwise)". An open tour was given as solution. [For closed tours see Jelliss *J. Rec. Math.* 1996]

FCR Oct 1947 ¶7462 raised the problem of forming a tour with four stars in the corners and in other positions on the board. This led to a considerable amount of work by solvers, including F. Hansson, W. H. Reilly and H. D. Benjamin, as reported two years later (*FCR* November 1949).

FCR vol.6 #18 Jun 1948 p.138 ¶7715 and vol.7 #1 Aug 1948 p.4 (misnumbered 96) ¶7778. Solutions #1 p.6 (98) and #2 Oct 1948 p.14 (106), were unsuccessful attempts to show longer words in monogram-type tours.

FCR 1949-52 constructed four Figured tours showing arithmetic progressions with common difference 10 arranged along diagonals.

Benson, William H. See *New Recreations with Magic Squares* (1976).

Berg, E.J. van den: in *Problemist Fairy Chess Supplement* #12 1932 40-move root-85 leaper circuit (improving on a W. E. Lester result).

Bergholt, Ernest: pen name of Ernest George Binckes (1856 Worcester - 1925 Nov 18 Letchworth). [Biographical notes in *Games and Puzzles Journal* #13 May 1996 p.208 and Dec 1996 p.230]

Queen (a fashion magazine) 'Some Original Knight's Tours' 25 Dec 1915: Two 8×8 symmetric tours called Arabesque (a symmetrisation of the de Montmort tour) and Hour-Glass based on one in Pearson (1907). A handrwitten footnote [in Murray's copy] states that The Hour Glass tour is a "Solution of the problem: In a diametrally symmetrical tour, to make the greatest possible number of consecutive moves within the central 4^2." 1 Jan 1916: Two 8×8 symmetric tours showing long crosses, with discussion of symmetry terminology.

8 Jan 1916: Two tours based on Vandermonde and two others, all showing maximum 'direct quaternary' symmetry. 22 Jan 1916: Two symmetric closed tours of 80-cell cross-shaped boards improving on Dudeney (1910) and one of 84 cells showing 'oblique quaternary' symmetry. 29 Jan 1916: Four 10×10 tours two showing maximum direct quaternary symmetry and two oblique quaternary symmetry. [Offprint included among Murray's papers]

Memoranda on the Knight's Tours 1916. Communicated to W. W. Rouse Ball Esq. [These manuscripts, in a retyped format, were preserved among H. J. R. Murray's papers under the heading 'Miscellaneous Articles and Notes by Ernest Bergholt'. The series continues as 'Memoirs' 1918.]

First Memorandum: 24 Feb 1916, deals with terminology for symmetry in tours, direct and oblique, binary and quaternary, and methods of construction, with examples 6×8, 7×7, 8×8, and on 80-cell cross.

Second Memorandum: 14 Mar 1916, gives a scathing review of Volpicelli (1872).

Third Memorandum: 30 Mar 1916, analyses the 6×6 board for quaternary symmetry by his methods, confirming the five solutions found by de Hijo (1882), and uses one, repeated four times, to make a 12×12.

Fourth Memorandum: missing, but there is a hand-written note on enumeration of 16-move circuits in quaternary symmetry, classified by pattern of central angles, which may have been omitted because duplicating the work of de Hijo (1882), which he cites in later memoirs.

Fifth Memorandum: 1 Apr 1916, 'domino' method of marking alternate pairs of cells (similar to Sainte-Marie's method on the 4×8 board) and covering each set with a path, then joining the two paths; examples 8×10, 8×8, with methods of closure and symmetrisation.

Sixth Memorandum: 22 Jun 1917. (1) Corrects mistake of Euler (1759) by giving closed tours 3×10 and 3×12. (2) Introduces a new species of diametral symmetry, i.e. 'Bergholtian symmetry' (so named by Murray presumably, though possibly by himself), with examples 5×8, 6×7 etc. (3) Criticises Jaenisch. Elaborates his methods for symmetry on 8×8, with example by Käfer (1842). Results on piece-wise symmetric tours such as F. P. H (1825). (4) Supplementary note, dated 27 Aug 1917, on spelling of Col(l)ini.

The British Chess Magazine 1918 'Knight's Tours' A series of letters p.7-8, 48, 74, 104, 195, 262. (1) His idea of 'perfect' quaternary symmetry on the 8×8 board, formed of a mixture of sets of four moves in direct and oblique quaternary symmetry. Presented as problems to complete tours including given central moves. Five example solutions. (2) Example tour with two three-move lines. The problem of a symmetric tour with maximum three-move lines. Solution with eight such lines. He wrote: "A correct solution ... was sent in by Mr G. L. Moore. His eight lines are not parallel, but that condition was purposely omitted by me, in order to make the problem easier to solve." Moore in fact found two other solutions. (3) The existence of closed tours on 3-rank boards, contrary to a statement of Euler, with examples 3×10 and 3×12 (as in his 1916 sixth memorandum). He and G. L. Moore (1920) found all six 3×10 solutions, although Kraitchik (1927) was the first to publish all six. (4) Binary symmetry on 7×8 board (a further example to those given in the 6th memorandum). (5) Given a central pattern, to complete a tour with maximum symmetry. The existence of further work on the subject was mentioned at the end of this series, where he wrote: "I need scarcely say that I do not construct such tours as these at random, but on demonstrable mathematical principles, which I have explained in a series of manuscript memoirs. They are in the custody of Mr H. J. R. Murray." Details follow.

Memoirs on the Knight's Tours 1918, communicated to Mr H. J. R. Murray. These continue the series of Memoranda previously sent to W. W. Rouse Ball. These memoirs develop Bergholt's idea of 'Complete' or 'Perfect' Quaternary Symmetry (termed by Murray 'Mixed' QS) on the 8×8 and 12×12 boards, where true quaternary symmetry is not possible.

Seventh Memoir 16 Jan 1918 Method of Terminal Loops. Nine examples on 12×12 board and 8×8 with examples from Brede (1844). Addendum 22 Jan 1918, Further example from Brede, and on 88-cell shaped board.

Eighth Memoir 23 Feb 1918. Method of Terminal Loops with Symmetrical Nodes: Generates 14 tours on 8×8.

Ninth Memoir 7 Mar 1918. Coalescing Loops. Explained by 12×12 examples. Generates 75 tours 8×8 (three other cases found by Jelliss 2001).

The Games and Puzzles Journal Biographical notes on Bergholt (#13 May 1996 p.208 and #14 Dec 1996 p.230) based on research by T. H. Willcocks. The above unpublished mss from 1915-18 are reproduced with commentary and biographical notes (vol.2 #13 May 1996 p.208, 213-217 and #14 Dec 1996 p.230-237 and #18 Mar 2001 p.321, 327-341).

Berloquin, Pierre 'Jeux et Paradoxes' *Science et Vie* (1979). 'Manoeuvres de Cavalerie' *Jeux at Strategie* (1982). See Moricard.

Bernhauer, F. 'Der Rösselsprung im Manasollasa', *Beiträge des Südasien-Instituts* (Heft 8, 1995, p.109-122). Aus dem wissenschaftlichen Leben. The *Manasollasa*, is translated as 'Freude des Geistes' ('Delight of the Spirit') and is described as a 'Fürstenspiegel' ('Princely Mirror') written for King **Somesvara** III of the Kalyani area in central India (c. 1150).

Bertrand, Louis, of Geneva (1731-1812). His method of transforming knight tours is acknowledged by Euler (1759). However, his 1778 work on Mathematics *Developpement Nouveau de la Partie Elementaire des Mathematiques* (Genève 1778) cited by Jaenisch 1862, mentions other work related to Euler, but does not appear to include anything on knight tours alas.

Bessy, de: See Frénicle.

Betts, Douglas A.; *Chess, an Annotated Bibliography* 1974.

Beverley, William Roxby (c.1814 Richmond Surrey - 1889 May 17 Hampstead London) 'On the Magic Square of the Knight's March', *The London and Edinburgh Philosophical Magazine and Journal of Science* (Taylor & Francis, London, ser.3 #220 Aug 1848 p.101–105).

A covering letter, published with the article reads: "Gentlemen, I inclose for insertion in the *Philosophical Magazine* a very interesting Magic Square, formed by numbering consecutively the moves of the knight in the grand tour of the chess-board. The knight's march has engaged the ingenuity of many eminent philosophers and mathematicians; but I believe that Mr W. Beverley is the first who has solved the difficult problem of converting it into a magic square. The principle upon which he has effected it, seems to be somewhat akin to that invented by Dr Roget, S.R.S., as explained in his paper on the Knight's Move in vol. xvi of the *Philosophical Magazine.* Yours very faithfuly, H. Perigal Jun.".

This implies that Beverley was not a mathematician: Perigal was (his name is associated with a visual proof of the theorem of Pythagoras). This is probably why Beverley wrote via Perigal and not direct to the editors of the journal. Staunton republished the article in his *Chess Player's Chronicle* (Nov 1848 p.344-347), and von Oppen made it known in Germany: 'William Beverley's Rösselsprung' *Schachzeitung* (vol. 4, p.21–24, Jan 1849).

The *Dictionary of National Biography* (Supplement 1901) has an extensive entry for William Roxby Beverley who is probably the knight's tour Beverley, though our evidence for this is purely circumstantial (i.e. he was in the right area of London at the right time). In the article his address is given as 9 Upper Terrace, Islington, in London. This address no longer exists; it was that part of Upper Street where Islington Town Hall now stands. It seems Beverley only lodged there for a short while; he is not recorded as residing there in the census records for 1841 or 1851. He was a scene painter and designer of theatrical effects, and travelled round the country quite a lot in the course of this work. He is recorded as being in London from 1846 onwards, working at the Princess's Theatre, the Lyceum, Covent Garden and Drury Lane, and exhibited water colours at the Royal Academy.

William had three older brothers, Samuel, Henry and Robert. Henry Roxby Beverley (1796-1863) controlled the Victoria Theatre, London for a short time, and "died at 26 Russell Square, the house of his brother Mr William Beverley the eminent scene painter". (This address is currently an Annex of Birkbeck College, University of London.) Their father William Roxby (1765-1842) was an actor-manager and adopted Beverley as a stage name, after his home town, the old capital of the East Riding of Yorkshire.

Bhatta see Damodara and Nilakantha.

Biddle, D. *Mathematical Questions with their Solutions from the Educational Times* (1884 vol.41 p.70-72) Editor W. J. C. Miller. Problem of finding the probability with which a knight can get between given cells in a given number of moves. Solution by D. Biddle. Listed in German bibliographies as: 'Wahrscheinlichkeitsbetrachtungen uber den Rösselsprung' [A] [online]

Bidev, Pavle (1912 Jun 22 Serbia - 1988 Jan 16 Macedonia) [dates from www.chessgames.com]: *FIDE Magazine* (#2 1964, #4 1964 and #2 1965). Material concerning magic squares and chess, included in his book of 1986 [cited by W.Korn (1980)]. 'Arabische Schachmeister machen Rösselsprunge im 9 Jahrhundert!' Bidev 1979 [K]. 'Der magische Rösselsprung in Geschichte und Gegenwart ' Bidev 1980 [K]. *Did Chess Originate in India or China* (Bidev 1986). Expounds his theories about origin of chess related to 8×8 magic squares. Reproduces a number of articles by other authors.

Bigelow, H.R.; Translator of U. Papa article in *Chess Amateur* 1922.

Bilguer, (Lieut) Paul Rudolph von (1815 Sep 21 - 1840 Sep 16) *Handbuch des Schachspiels*. 1st edition, p.4-5, 1843 (completed after Bilguer's death (aged only 24) by von der Lasa, who was editor of many subsequent editions, e.g. 4th edn, 1874 p.12.). There are three irregular tours.

Billig, Eduard *Der Rösselsprung mit Variationen* Mittweyda 1831 [one tour 64 times according to Murray] [K4070]

Bingham, —: Editor of an English edition of Ozanam (1790) *Recreations* 1820. [M]

Blanshard, Charles Thomas (1852 Jan 26 Leeds - 1924 Aug) *Chess Amateur* Aug 1923 'A Knight's Tour' p.349. Gives a 'four-loop tour' said to have been found by him before the war, i.e. in 1913. This is in effect formed by simple linking of the unique pseudotour formed of four shaped quarterboard circuits (Ala'addin 1400, de Hijo 1882) [BCPS Library]

Blathy, O. T. in 'The Problem of the Knight's Tour' *Chess Amateur* 1923 §25 Uses a statistical argument to estimate of number of 8×8 tours and arrives at the estimate of 6×(10^11).

Böcklin, C. *Archiev der Math.* 1889.

Bondy, J. A. See *Graph Theory with Applications* (1977).

Bonsdorff, Eero: See *Schach und Zahl* (1978).

Bonus Socius {Good Companion}; the name given to the compiler of the first large collection of mediaeval chess problems of which numerous manuscript copies survive, written over a long period (c.1250 - 1350). Nicolas de Nicolai scribed one version.

Bossut, Charles (1730-1814) See *Dizionario Enciclopedico delle Matematice* (1800).

Boutin, A.: *L'Intermédiaire des Mathématiciens* (Paris vol.8 1901 p.153-4). Question on the number of rook tours of a rectangular board. See Sainte-Marie (1904). [Rouse-Ball 1939, p.186].

Bouvier, Charles, penname 'Adsum'. Magic tour (05a) is the first to make use of irregular quartes but I have not found where this appeared. It is assigned 1876 in Murray's catalogue. [Only two others use this type of zigzag quarte, namely (00j) and (27f) by Reuss 1880.]

Bouvier produced another magic knight tour in 1882 (05d) [By deduction I suspect that this is one of two new magic tours noted by Feisthamel (in *Le Siècle* 18 Aug 1882) as being published in another French journal *Le Telegraph*e (Problem Nos 1232 and 1239) between May and August that year, but I've not seen this source.]

Bouvier published three more in *Le Siècle* ¶2326 11 Apr 1884 (12i), (12j), (00l). These are the first to make no use of squares, diamonds or Beverley quartes, all 16 quartes are extended over cells in two quarters. The first two are symmetric. The third tour (shown here) is asymmetric and cyclic with two magic numberings. These tours are also 'Jaenischian', having the ends of the quarters 1, 16, 17, 32, 33, 48, 49, 64, in a knight circuit.

Boy's Own Conjuring Book 1860, 'Moving the Knight over all the Squares Alternately' (Art.45 p.246–251. After G. Walker (1840). [Singmaster, 1991]

Braadbaart, Bension Hela (1838-1882): two ms *De Paardensprung in het Schaakspel* ..., Zaandam, 1865, 54 pages, and 1866, 70 pages. [C][K4083/4]

Brede, Ferdinand Julius (1800-1849) *Almanach für Freunde vom Schachspiel* (Altona 1844) [M] [Now in Google Books.] This work, like Käfer (1842), has 24 tours in diagram form at the end of the book, but printed one to a page instead of on a fold-out sheet. These are preceded by a tour in numerical form with the title 'Gleichsummiger Rosselsprung' {Equal-summed Knight tour}.

This is a semi-magic tour adding to 260 in all files, formed by joining a 4×8 semi-magic tour to a copy of itself (Zuckermandel 1838 gave an earlier example). All the tours show 180 degree rotational symmetry, apart from #14 which is identical to Laisement #6A but rotated 90 degrees, and shows approximate birotary symmetry. Three of the tours (#5, #6, #12) are cited by Bergholt (1918) as examples of mixed quaternary symmetry; in fact #5 shows maximum oblique quaternary symmetry. Tours #10 and #11 both have sizes 9 and 1 squares centred (as also shown by Käfer). Some of the lines in the tours are shown bolder than others to emphasise particular patterns. Apart from the last three tours they are all of the type with the four central angles equal. See the Symmetry section (p.468) for full diagrams.

Brewer's Dictionary of Phrase and Fable (1974, p.142, 698). Boustrophedonal. Maeander.

British Chess Magazine (founded 1881) Tour articles by Murray (1902, 1911, 1917, 1949) and tours by Akenhead, Dawson, Fraser. Anon 1922 vol.42 p.468. Tours required h1-a1, h1-f2, e5-e4, g1-b8 (the latter impossible). 1923 vol.43 p.357 Review of *Feats in Chess* by S. Rangiah Naidu.

British Museum An Arabic ms dated 1257. Knight and Pawn puzzles. [Murray 1902]

Brown, John W. *Notes & Queries* (1919 ser.12 vol.5 p.92) [online]. Original query, p.136. Cites Roget (diamond and square method) and Tomlinson p.325. Gives a Collini style open tour b5-g5, though apparently not aware of previous work.

Brown, Peter G. *Loci* July 2012 ‘The Magic Squares of Manuel Moschopoulos’. MAA website.

Brown, Ronald R. *Leonardo* vol.25 #1 1992 ‘The Use of The Knight's Tour to Create Abstract Art’ p.55-58. *Bridges: Mathematical Connections in Art, Music, and Science*; (ed. Reza Sarhangi) Conference Proceedings Towson University 2002 ‘The Knight's Tour Problem as a Conceptual Tool for Interdisciplinary Studies’ p.169-180.

Browne, William Hand (1826-1912) *New Eclectic Magazine* Baltimore Apr 1870 vol.6 ‘Dictation Tours of the Chess Knight’ p.481-7. [C] The method described is essentially that of Roget (1840) but this source is not cited instead the article is stated to be “Chiefly founded upon A. Crétaine's *Etudes* Paris 1865.” The introduction mentions Euler (1759) and Jaenisch (1862). The name ‘Dictation Tour’ has a double meaning. A spectator ‘dictates’ the two squares of opposite colour between which a tour is to be constructed, and the successive moves are then verbally ‘dictated’ by the performer, without sight of the board, where it is recorded by an assistant. He notes that the initial cell can be chosen in 64 ways and the final cell, of opposite colour in 32 ways, giving $64 \cdot 32 = 2048$ cases. As in Lavernede he reduces this to 256 (though by a somewhat dubious argument) consisting of classes of 128 (where the four series of quartes are toured whole), 64 (where a series is split up), 48 (with start and end in different quartes of the same series) and 16 (with start and end in the same quarte). Example tours are shown in diagram form, using white lines on a black background, and at the end as a series of squares named in a tabular descriptive notation from White's point of view, for instance the first tour begins QKt7-Q8-QB6-QR5:

Brügge, Joachim: *Die Schwalbe* (#94 Aug 1985 p.505-9) ‘Der Wanderer (Q, K, R, N) und sein Schatten (1, 2, 3, ..., 64); Magische Quadrate in Verbindung mit Figurenwanderung auf dem 8×8 Brett’ (magic king queen and rook tours). (#112 Aug 1988 p.449-454) ‘Symmetriebruch als Phanomen semi- magischer {i.e. magic but not diagonally magic} Springerwanderungen’ (analysis of three 12×12 magic tours by T. H. Willcocks).

Brunacci, (Prof.) Vicenzo *Compendio del Calcolo Sublime* (Milan 1811, vol.1 p.74-78) Euler. [C]

Brunet, Georges Edouard Auguste (1856-1900) *Analysis Situs, Recherches sur Réseaux* 1894.

Buni, Ahmed al-; c.1225. 'Showed how to construct magic squares using a simple bordering technique.' [Brown (2012)]. Various manuscripts, including 4×4 magic squares, using letters as numbers, with the top row spelling a word. [Singmaster 1991, p.218-9]

Burmese Chess Guide (1924). Contains tours in Burmese numeration, 129 tours 8×8, those I have examined being asymmetrical, two 6×6, two on 6×6 with corners removed, eight on 4×4 with corners removed, one on 3×8, and some other diagrams with non-numerical symbols. This may be derived from Volpicelli 1872. [Copy from David Pritchard 1990]

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Cairo: Manuscript dated c.1370 in Khedival Library, ref: Mustafa Pasha #8201, with three of the tours given by al-Baghdadi 1141. [Murray 1913]

Cahiers de l'Echiquier Francais 'Le Problème du Cavalier' [Editor Lancel?] Article on monogram tours by T. R. Dawson and H. Rohr. Also quotes cryptotour p.168 (sol p.256) from *Le Palamède* 1842 (see Poilly). Two versions of the magic tour (00a) by Jaenisch p.390. And a lettered tour problem solved by a quotation from Barbey d'Aurevilly: (See Cryptotours p.408-410.)

Caldwell, E.C. *English Mechanic and World of Science* (vol.29 1879 p.317) 'The Knight's Tour on the Chessboard as a Magic Square'. Gives two magic knight's tours, one quoted from "a modern French Cyclopedia" *Larousse's Dictionnaire Universel* which is Jaenisch (12o) in our catalogue and the other "is original and has never before been published" (05b). Both are of squares and diamonds type. He notes: "...the errors in excess in one section are made to compensate the errors in defect in another section, and vice versa."

Calvo, José Ricardo Gomez (1943 Oct 22 - 2002 Sep 22) *Irregular News* Feb 1997. This includes items on history of knight tours, the 'Safardi' magic square, and a selection of ornamental knight tours, which are mainly from Falkener (1892).

Canel, A.: *Recherches sur les jeux d`esprit, les singularités et les bizarreries littéraires, principalement en France* (2 vols, Evreux 1867). A cryptotour from this is quoted in H. Haughton *The Chatto Book of Nonsense Poetry*, Chatto & Windus, London (1988). The board in Haughton is chequered and the letters on the black cells are white. (See Cryptotours p.409.)

Carpenter, G.E. (problem editor for issues 1 and 2) *Brentano's Chess Monthly* (New York 1881 vol.1 #1 May 1881 p.36) 'Prize Knight's Tour. To construct a complete knight's tour of the board, that, the squares being numbered consecutively from 1 to 64, the square numbers 1, 4, 9, 16, 25, 36, 49, and 64 will occupy one band or column of squares.' Solutions given by S. Hertzsprung (#5 Sep 1881 p.248-249). [British Library: PP1831.l]

Cartouche, (Mlle), à Rennes (pen name) *Gil Blas* 21 Sep 1880 ¶307 gives a knight open cryptotour with one letter per cell and the name MEPHISTO along the top rank (See Cryptotours p.410.)

Carus, Paul: (editor 1890-1919) *The Monist*. A journal of philosophy that included articles on magic squares etc. Source of chapters of Andrews *Magic Squares and Cubes* 1917.

Cashmore, M.; *Chess Magic Squares* 1908. On magic squares constructed using chess moves. Published 'in a journal of Capetown'. Reproduced in Bidev (1986) p.24, 46–48, 82–85.

Cassani, F. *Die Schwalbe* (a chess problem magazine) 1931 Grasshopper paths.

Castilho, Alexandre Magne de (1836 - 1874): *Récueil de Souvenirs du Cours de Mnémotechnie*, Saint-Malo, 1831. [C] Not seen by me.

Célina Fr, Mme; pen name of Edouard Francony.

Cerchi, **Teofrasto**: Editor *Giuochi Fisici e Matematici i Piu Belli Finora Immaginati collagiunta della loro spiegazione e construzione, e del modo di eseguirli* (l`Erede Pazzoni, Mantova, 2 vols, 1817–18, vol.2 p.98-115 Giuoco 31). Italian edition of Guyot (1769). [C]

Chachi, Johannes, of Terni; 1511, 4×8 tour in ms of chess problems [Murray 1913, p.727, 730].

Chambure, Eugéne Pelletier de (1813 - 1897) 'Séance du 5 Mars 1861' *Bulletin de l`Institut Egyptien* (vol.1 p.80-81). This just notes his presentation and its acceptance for publication as: 'Du Problème Relatif a la Marche du Cavalier au Jeu des Echecs' *Mémoires présenté a l`Institut Egyptien, Cairo* (1861 p.67-86, Paris 1862) [C] [K4080] [online]

The introduction cites Euler, Vandermonde, Colini (sic), Ciccolini, Legendre, Moon, Volpicelli (1851) and Mindeng (sic). However Roget (1840) is not cited, so Chambure seems to have discovered the same method independently. Instead of Roget's L e a P notation he uses r B b R indicating red and blue colouring in light and dark shades. In plate 3 he indicates how 15-move knight routes on the 8×8 board can be reduced to wazir tours on the 4×4 board (or along the edges of a 3×3 board to be more precise), showing 38 cases (the correct total) classified by end points. The diagrams relating to the method are Fig.20 (Plate 6) and Figs 23 and 26 (Plate 7).

The slants are shown as red lines in the first two but are omitted in the third. As in Roget they solve the three cases where the end-points are on compatible nets, on incompatible nets, or on the same net. For diagrams of these see the section on Roget's Nets.

The article also includes other unrelated tours. Plate 8 has three closed tours (Figs 27, 28, 29). The first is symmetric (cc~). Plate 9 has six more closed tours with approximate symmetry. He concludes with an attempt at enumeration, claiming there are 40320 (i.e. 8 factorial) ways of arranging Rs and Bs etc, but it is unclear how he arrives at this figure.

Lucas 1895 wrote: "Cet auteur se sert de quatre coulours; les développements de la méthode sont agréables à l'oeil, mais peu aisés placer dans la mémoire; les circuits qu'il donne sont des chefs-d'oeuvre de difficulté vaincue."

Chapais, — *Essais analytiques sur les Echecs* ms Paris 1780. Endgame theory with work on 'le probleme du cavalier' at the end p.485-496 based on 'Coliny' (i.e. Collini). [Cleveland Library has: 'Copy of Ms. no. 500/584 v. d. Lasa library, made by Joseph Klapper, 1 Jun 1910'] The name might refer to a member of the prominent Canadian Chapais family. This is a conjecture based on his description of himself in the ms as a trader (*négotiant*) in Paris. Has 10 tours of Collini type and examples on boards of sides 9, 10, 11 and 12. [Information on this manuscript was kindly supplied to me by Herbert Bastian, Aug 2017]

Charpentier, Jean Baptiste Alexandre *Du Jeu des Echecs a la Portee des Jeunes Gens ...* Paris 1844 [L] Some tours cited as from this work are in fact from Käfer 1842. *Anciens et Nouveaux Jeux Géométriques, ..., combinaisons curieuse sur la marche simple et double du cavalier aux echecs*, Paris 1849. [A] [C] [K4076] A tour with approximate axial symmetry is cited by Murray.

Chess Amateur magazine (1906-1930) published by Harry Harmer, Stroud News. 1922 article on enumeration of knight tours with contributions by Adamson, Blathy, Dawson, Douglas, Papa.

Chessics magazine published by G. P. Jelliss, 30 issues 1976-1987 devoted mainly to variant chess problems, and mathematical puzzles related to chess. The term 'chessics' meaning the interface of chess and mathematics. From issue 14 onwards subtitled *The Journal of Generalised Chess*. Tour contributors include: 1978, W. H. Cozens*;* 1978, 1987, A. S. M. Dickins; 1983, C. Grimstone; 1985 A. I. Houston; 1976–81, 84–86, G. P. Jelliss; 1981, 1983, 1987, T. W. Marlow; 1978, 79 J. J. Secker; 1976, 78, 82 C. M. B. Tylor; 1976, 78, 85–6 T. H. Willcocks; 1982 S. Ylikarjula. [Free in PDF form from www.mayhematics.com]

Chicco, Adriano See *Dizionario encyclopedico degli scacchi*.

Ciccolini, Giuseppe *Il Nuovo Tesoro degli Scacchi* Rome 1827 4 tours? [L] [Google Books] However I could find no tours in the Google version.

Ciccolini, Teodoro (Marchese di Guardiagrele): *Del Cavallo degli Scacchi* (Paris, Bachelier, 1836, 120 pages. Text followed by 25 'Tabula', which are lists of tour formulas and some diagrams). [C] [K4071] [Oxford University Library 1.delta.458.] One tour of squares and diamonds type, but others derived by Euler's method. Also two 10×10 tours.

City of London Chess Magazine, The (1875 vol.2 #7 p.197). Gives details of the Italian book edition of Volpicelli (1872), 400 pages quarto, published in Rome. [Whyld]

Civis Bononiae {Citizen of Bologna}; The name given to the second main collection of mediaeval chess problems; mss c.1350-1500. Like the earlier Bonus Socius collection this compilation also exists in numerous ms copies. The 4×8 tour is identical to one of the six solutions in the Nicolai version of Bonus Socius. [Linde 1874, p.245, 292–5, Murray 1913, p.643-8, 674]

Clausen, (Dr) T. *Archiv der Mathematik und Physik ...* (1853 vol.21 p.91-92) 'Direkte Auflösung des Rösselsprung' [A] also (same author and date?) ser.3 vol.3 p.136–151 [C] Not seen by me.

Cognet, G. *La secret du bouclage de la boucle* {loop the loop} *aux echecs. Memoire sur la polygraphie du cavalier* (Constantine 1917) [K4110] *L'Echiquier*, Oct 1930. Bergholtian tour of 64-cell serrated board.

Collini, Cosimo Alessandro (1727 Oct 14 Florence - 1806 Mar 21 Mannheim) was at various times Private Secretary to Voltaire and to the Elector Palatine. His first publication on knight's tours is an article 'Résponse à un problème sur le jeu des échecs' spread over several issues of the *Journal Encyclopédique* (vol.6, Sep 1772, part 3, p.453–462; vol.7, Oct 1772, part 1, p.112–118, part 2, 283–290).

The author is named as Monsieur Colini [sic], Secrétaire intime de S. A. E. Palatine. One tour is shown, on p.116. He published a book length account the next year: *Solution du Problème du Cavalier au Jeu des Echecs* (by Monsieur C—, à Mannheim, chez Tobie Loeffler, au Chandelier d'Or, 1773). This is a book of 60 pages, including 28 tables, 20 of which are tours (Tables 5, 7–9, 11, 13–21, 23–28). Part I of the book prescribes the initial square, Part II the final square, Part III a closed tour, and Part IV different start and finish squares. Table (5) in the book is the tour shown in the 1772 Journal article. He also published an account in Italian in 1774: 'Soluzione del problema di percorrere col passo del Cavallo tutte le case della scacchiera' *Magazzino Toscano* (Firenze, Pietro Gaetano Viviani, 1774 p.182-186) [details from K. Whyld]

Collings, Stanley (Reader in Mathematics Faculty, Open University 1969-1981), *Chessics* (#29+30 1987 p.159-160) A note on 5×n tours.

Collins, Eliot W.; See Jackson D. E.

Comtes Rendus du Premier Congres International de Recreations Mathematiques Brussells (1935) edited by Maurice Kraitchik. With articles by T. R. Dawson on Figured Tours and E. Huber-Stockar on multi-mover tours.

Cook, E. B. (and other editors): *American Chess Nuts* (New York 1868 p.396). Gives the Loyd (1867) queen tour problem. [BCPS Library]

Corinda, Tony (alias of Thomas William Simpson 1930 May 17 - 2010 Jul 1) *Thirteen Steps to Mentalism* D. Robbins & Co 1964. Knight's tour as a magic trick. He numbers the cells of the board 1 to 64 row by row, and memorises the sequence of cells entered by the closed tour, which is irregular. [Information from Harold Cataquet]

***Cosmos**: Revue Encyclopédique Hebdomadaire des Progrès des Sciences et leurs Applications aux Arts et l`Industrie* (A. Tramblay, Paris vol.18 1861 p.489) A review of Polignac. [C]

Coxeter, (Prof) Harold Scott Macdonald (1907-2003). Editor of new editions of W. W. Rouse Ball's *Mathematical Recreations and Essays*, 11th edition 1939; 12th 1974, 13th 1987, but the material on knight's tours does not appear to have been revised at all. The magic square 10x10 by E. T. Parker is included as frontispiece. *Introduction to Geometry* (John Wiley 1961, second edition 1969). Uses the term *direct* to describe symmetric operations in opposite sense to that of Bergholt. [My own copies]

Cozens, William Harold (1911 Oct 20 Longstock - 1984 Jul 16 Taunton)

Mathematical Gazette 'Cyclically Symmetric Knights Tours' (Dec 1940 p.315) includes the five 6×6 quaternary tours. Note 2761 (May 1958 p.124) with diagrams of the five 6×6 tours, in response to Note 2592 by Apsimon. Note 2884 (May 1960 p.117) further response to Note 2592 by ApSimon): Estimates 200,000 on the 10×10 board, and gives four examples.

Fairy Chess Review (vol.6 #5 Apr 1946 p.33) ¶6768 monogram tour for TGPollard.

Chessics (#6 Aug 1978 p.4-5) Giraffe and Zebra 10×10 quaternary tours.

Notebooks by WHC in the BCPS Archive also contain many 10×10 quaternary knight tours.

Crétaine, A. C. *Etudes sur le Problème de la Marche du Cavalier au Jeu des Echecs* ... Paris 1865. [C] [K 4085.] [online] There are 19 numbered plates each with six diagrams, and seven lettered plates. A tour showing a nice ornamental letter W, not needing to be picked out in darker lines, was cited by Dawson (1928); this is an improvement on a similar open tour design by G. Mann (1859). This work is cited by Browne (1870) as his main source for squares and diamonds. Plate D includes an indexed diagram using the letters PUOL, OLPU, UPLO, LOUP (meaning wolf) instead of Roget's LEAP. Both Roget and Lavernède are cited in the introduction, together with most of the usual suspects. The majority of the tours are of the near axial variety, only 11 on PLates A and B being symmetric, one being a double half-board tour by Euler. Includes a tour with an 11-move Greek Cross, as earlier shown by Solvyns (1856). A final section concerns the eight queens problem.

Cross, Harold Holgate (1909 Apr 20 Barton-on-Humber - 1962 Aug 9) *Fairy Chess Review* (vol.4 #10 Feb 1941 p.128, sol #11 Apr 1941 p.137-8) ¶4709 10×10 open zebra tour.

Cubison, W.M. *Chess Monthly* Jun-Aug 1896 'The Knight's Tour'. Closed tour 64×64.(very large! or is this a misprint?) [M] Not seen by me.

Cutler, G. W. *The British Chess Magazine* (1911 vol.31 Dec p.464-5). An account of the squares and diamonds method (misattributed to C. E. Orme in the 1860s [a refernce I have been unable to trace]. Editor cites Roget 1840 and *Leisure Hour* 1873.

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D—, J..B. [name unknown]: *The Leisure Hour: A Family Journal of Instruction and Recreation* (vol.22 #1133, 1873 p.587-590, 752) 'The Knight's Tour'. (a) A cryptotour encoding 'O County Guy' by Walter Scott. The lines are presented using three letters to a cell as in Problem VII (1871) in Staunton's *ILN* column. (b) "Many a leisure hour, no doubt, has been spent, especially of late, in constructing and unravelling those tangles of letters, which, inscribed in the squares of an imaginary chessboard at intervals of a knight's move from each other, make up the elaborate puzzles which go by the name of Knight's Tours ... exercises of patience." This is evidently a reference to the popularity of the cryptotour problems in Staunton's column. (c) An account of Roget's method with seven examples. "The fullest statement on the subject in any modern book is probably to be found in Dr Roget's article ... but the solutions here suggested, though necessarily founded on common principles, are not given by the learned doctor, and have not, to the writer's knowledge, appeared before." The tours given can all be regarded as formed from the H crosspatch pseudotour by deletions and insertions. (d) The article concludes with attempts to count numbers of types of tour classified by end cells. This continues on p.752 where the author attempts to correct the errors. A correct account was given later by Heinrich Meyer in the same journal. [Leicester University Library: PER 05C.L4244.]

Daidalos (Latinised: Daedalus); Legendary Minoan Labyrinth Builder, c. –1600.

Dalfsen, P. B. van: *Fairy Chess Review* 1951, 1953. Gave symmetric solutions to as Suli's problem of alternating fers-knight and alfil-knight.

Damodara (Bhatta) *Yantracintamani* (c.1550). The name 'Bhatta' is a title signifying a scholar. Wikipedia describes this is a text about the use of Yantras (mystical diagrams) in the performance of magical rites. It apparently includes the tour attributed to Nilakantha.

Dawson, (Miss) Dorothy R. *Evening News* 1932; *Fairy Chess Review* 1936; vol.4 #3 Dec 1939 ¶4131 3D's monogram p.43.

Dawson, Thomas Rayner (1889 Nov 28 Leeds - 1951 Dec 16 Croydon);

Cheltenham Examiner 1913 'Caissa's Playthings' This includes a camel tour.

Pittsburgh Gazette-Times 1917 (with C. D. Locock) puzzle leading to a shaped knight tour;

Scheveningen Chess Society 1922 tourney for 'S' compositions on its 10th anniversary, won by a simple 'S' monogram tour. [Reported in *Chess Amateur*]

Chess Amateur 'Chessboard Puzzles' series, vol.3 (1908/9) ¶28 Rook tour after J. R. Mattey in 15 moves a1-a6, p.115, 179; *CA* 1922 editor of article on tours with numerous contributors (see U. Papa 1922) §24 Dawson notes the estimate for the number of tours on the 8×8 as 168C63 attributed to Dudeney (actually in Jaenisch 1862). He approximates this as < 122×(10^45); *CA* Mar 1924 asks what is the smallest rectangular lattice on which a knight may describe a triangle. Answer a triangle of 3, 4 and 5 moves on a board 9×11; *CA* Aug 1925 gave a list of two-pattern (and larger) fixed distance leapers on larger boards; *CA* 1928 (?);

Cahiers de l'Echiquier Francais 'Le Problème du Cavalier' (1928 p.166-168, 256, 388–91). An historical account of monogram tours, with 'CEF' monogram p.167.

L'Echiquier (Brussels) 1928 p.985, 1054; 1930 p.1086; 1931 p.1150, shows the three giraffe open tours on 5×8 board, the smallest possible, and the longest non-crossing knight paths (35 moves), and 32-move circuit without crosslinks, also a 'progressive leaper' result. 'Echecs Feeriques' column by Dawson in *L'Echiquier* Dec 1930 (problem 186, p.1085). The problem of the longest non-crossing knight path on the 8×8 board was proposed, with an example of 30 moves to show the idea. Solutions were given in Jan 1931 (p.1150) in algebraic coordinate form, with two open paths of 35 moves by Dawson and a closed path of 32 moves by the Romanian chess problemist Wolfgang Pauly (1876-1934). See Noncrossing Tours section for diagrams.

British Chess Magazine (1932 vol.52 p.182) ¶3044 figured tour with squares in open knight path. (1938 vol.58 p.436, sol p.526) Shortest closed knight-journey with every move-line intersected by two others. (1940 vol.60 p.71, 108, 144, sol p.141, 182, 217) Tours with triangular numbers 1, 3, 6, 10, 15, 21, 28, 36, 45, 55 in a triangle. (1941 vol.61 p.32, sol p.94) Tour with pentagonal numbers in pentagon: 1 d4, 5 e3, 12 b5, 22 f5, 35 c3, 51 d6. (1942 vol.62 p.23, sol p.70) ¶5674 tour with squares and cubes in closed knight chains. (1943 vol.63 p.23, sol p.70) ¶5970 tour with squares forming an 8-Queens position. (1943 vol.63 p.285, sol 1944 p.45) ¶6249 WKb1, BSf8, the knight moves to check and may never move to bg45 de124578 (16 cells in all), White compels it to occupy all the other squares once each (same as Dawson and Locock 1917?). (1944 vol.64 p.220, sol p.269) ¶6496 MMMM monogram tour: "HJRM ... has demonstrated that there are 13 possible tours in all". (1945 vol.65 p.155, 201) ¶6754 monogram FWM. (1944 BCM?) nonintersecting knight + camel = gnu tour.

Evening News 1932 (including work by Miss Dorothy R. Dawson);

Evening Standard 1933 tour with double triangle numbers n(n+1) namely 2, 6, 12, 20, 30, 42, 56 in a figure of eight formation, and Rook magic square puzzle.

Congres Internationale de Recreation Mathematique 1935 Article with four Figured Tours that show arithmetical progressions with common difference 7, 7, 8 and 9. In the first the multiples of 7 are in the 3×3 area around d4. In the second the progression is 8, 15, 22, 29, 36, 43, 50, 57, 64. The third has the multiples of 8 in order of magnitude along the diagonal (this was composed without knowledge of the earlier work by Krishnaraja Wodeyar, the Rajah of Mysore). The fourth tour shows the arithmetic progression 1, 10, 19, 28, 37, 46, 55, 64 along the fifth rank. The 9-move segments of this tour are alternately in the lower and upper ranks of the board.

Caissa's Wild Roses 1935, the first of four books in the C. M. Fox series that contain tours on the title pages lettered A...Z&A...Z&A...J to show dedicatory words. The ampersands are inserted between A and Z to give an odd number of symbols, so that a letter can occur on cells of either colour. See Lettered Tours section.

Problemist Fairy Chess Supplement Editor 1932–6 (vol.1 #10 Feb 1932 p.53, 58) ¶329 first closed tour with square numbers in a knight chain, also an open figured tour (p.58 in the text), ¶330 "No.330 is the second known solution of the ten three-unit line tour first proposed by M. Hogrefe, Weser Ztg 13/7/24". (#11 Apr 1932 p.65) ¶381 an open tour in which the cubes also form a path, a task suggested by H. A. Adamson. (#12 Jun 1932 p.73-74) ¶450, ¶451 Dawsonian tours; comments: "The apparently pointless 451 is given to emphasise the usefulness of Ciccolini's squares and diamonds in constructions of this kind - the whole tour being made up of these units, with squares in S-chain.". [In mis-attributing the squares and diamonds to Ciccolini he is following earlier authorities such as Lucas and Ahrens. The tour is not strictly squares and diamonds since two moves are deleted from the top right diamond.] ¶459 shortest knight journey on 8×8 containing ten parallel three-unit lines, of 52 moves, and three two-unit lines (#13 Aug 1932 p.82) has 50-move solution. (#14 Oct 1932 p.90) ¶567 asymmetric polygon figured tour with square numbers in a knight chain composed to match an example sent by A. H. Haddy. (#18 Jun 1933 p.125) notes how Camel tours on the 8×8 are equivalent to Knight tours on a serrated board representing the 32 cells of one colour.

Tours with square numbers in a knight chain: vol.1 #10 Feb 1932 ¶329 p.53, 58, #11 Apr 1932 ¶377 p.64 and ¶381 p.65, #12 Jun1932 ¶450 p.73, #13 Aug 1932 ¶492-3 p.81, #14 Oct 1932 ¶566 p.90, #15 Dec 1932 ¶607-8 p.97, #16 Feb 1933 ¶660-1 p.105, #17 Apr 1933 p.113 ¶716, v.2 #1 Aug 1933 ¶910 mis-numbered 610 p.4, #2 Oct 1933 ¶981 p.14, #3 Dec 1933 ¶1053-*4* p.24, #5 Apr 1934 ¶1303-6 p.55-56, #7 Aug 1934 ¶1449-52 p.72, #8 Oct 1934 ¶1525-8 p.82-83, #9 Dec 1934 ¶1593-6 p.91-92, #10 Feb 1935 ¶1674-7 p.104, #11 Apr 1935 ¶1813-6 p.121, #12 Jun 1935 ¶1834-7 p.124-5, #13 Aug 1935 ¶1917-20 p.135, #18 Jun 1936 ¶2288-9 p.187.

Fairy Chess Review (editor 1936–51); (vol.2 #10 Feb 1935 p.108, sol #11 Apr 1935 p.117) ¶1706 square numbers in ring; (vol.6 #7 Aug 1946 p.46, sol #8 Oct 1946 p.57). ¶6880-6881 Monogram tours DB and HDB. *FCR* 1948 Completion of his collection of Figured Tours. *FCR* Nov 1949 p.68 states the total of 25 six-move circuits of knight and camel was reported "long ago in *Chess Amateur*" but I have not traced this earlier reference. *FCR* 1950 has Grasshopper tours.

Tours with square numbers in a knight chain: v.3 #1 Aug 1936 ¶2352-3 p.3, #2 Oct 1936 ¶2468-9 p.18, #3 Dec 1936 ¶2544-5 p.29, #4 Feb 1937 ¶2637-9 p.41, #5 Apr 1937 ¶2702-5 p.53-4, #6 Jun 1937 ¶2785-8 p.65, #7 Aug 1937 ¶2869-72 p.77, #13 Aug 1938 ¶3324 p.141, #14 Oct 1938 ¶3388 p.150, #15 Dec 1938 ¶3465 p.159, v.5 #12 Jun 1944 ¶6025-7 p.96, #13 Aug 1944 ¶6094 p.101, #15 Dec 1944 ¶6230-1 p.117, #16 Feb 1945 ¶6305-6 p.124, #17 Apr 1945 ¶6381-2 p.132, #18 Jun 1945 ¶6461-2 p.140, v.6 #2 Oct 1945 ¶6581-2 p.8 mis-numbered 148, #3 Dec 1945 ¶6636-7 p.17, #5 Apr 1946 ¶6775 p.33, #7 Aug 1946 ¶6932-3 p.50, #14 Oct 1947 ¶7474-5 p.110, #15 Dec 1947 ¶7535-6 p.118, #18 Jun 1948 ¶7716-8 p.138.

Vie Rennaise 19 Nov 1932 tour with even numbers 2-18 forming a 3×3 magic square.

Dehornoy, Pierre: 'Counting moves in knight's tours' *C. R. Acad Sci Paris* (Ser.I #336 2003 p.543-548). Tours on large boards with most of the moves in one or two directions.

Delannoy, H. Border braid tours in M. Frolow 1886. One of the editors of the posthumous works of Edouard Lucas.

Denken und Raten periodical published 1928-1935. 25 Aug 1929, two tours with oblique quaternary symmetry omitting 28 cells from the 12×12 in various places. 25 Jan 1931: a 78 cell tour on 8×10 board with two holes with Sulian symmetry. 15 Mar 1931: oblique quaternary tour on a board of 108 cells formed by omitting 36 cells from the corners of the 12×12. This tour has only four acute angles, at the centre. [collected by Murray 1942]

Dickins, Anthony Stewart Mackay (1914 Nov 1 Bath – 1987 Nov 25 Kew) *A Guide to Fairy Chess* 1967, 1969 , p.30. Generalises the concept of leaper to include multiple patterns and any kind of board. Distingushes zero from null leaper. *Chessics* #5 Jul 1978 4th-rank sol to Carpenter (1881) problem p.7-8. #29/30 1987 Tours of 6, 7 and 8 side p.163.

Dictionnaire des Echecs by Francois le Lionnais and Ernst Maget; tour is from Bilguer 1843.

Dictionnaire encyclopedique des amusements des sciences, Paris, 1792. A version of Ozanam's *Recreations*, with the same tours. [cited by Tarry 1872]

Diderot, Denis (1713-1784): See *Encyclopédie* 1751.

Dignal, F. [biographical details lacking] *Problemist Fairy Chess Supplement* vol.2 #1 Aug 1933 p.4 ¶907-8, #2 Oct 1933 p.14 ¶980, #3 Dec 1933 p.24 ¶1051-2, #4 Feb 1934 p.35 ¶1132-5. Dawsonian figured tours.

Dizionario Encyclopedico degli Scacchi by Adriano Chicco and Giorgio Porreca (U. Mursia & C 1971, 579 pages).

Dizionario Enciclopedico delle Matematice (Padova 1800, vol.5 p.107, 111). Euler's method. Charles Bossut (1730-1814) and Joseph-Jerome Lefrancais de Lalande (1732-1807) [M]

Dollinger, Joseph: *Ein hundert zehen ganz neu zusammengesetzte Schach-End-Spiele. Dann vier und zwanzig verschiedene Arten den Springer durch alle Felder hin und zuruck zu spielen, ohne ein Feld doppelt zu berühren* {110 quite new chess end-game compositions. Then 24 different ways for the knight to play through all the squares, there and back, without touching any square twice} (Anton Pichler, Vienna. 1806, p.61-84). [C] [OU shelfmark Murray e.81]

Douglas, F. *Chess Amateur* 1923 in 'The Problem of the Knight's Tour' Estimates the number of knight tours as (2^6)(3^20)(5^8)(7^8) approximated as < 210×(10^28). *CA* 1928 Fiveleaper partial tours [mentioned in *FCR*]; *Problemist Fairy Chess Supplement* (vol.1 #11 Apr 1932 p.68, sol #12 Jun 1932 p.75) ¶403 {3,4} leaper two doubly symmetrical circuits of 44 moves on the 8×8 board. Solution says: "It will be remembered that FD's longest tours in 4-fold symmetry [In *CA*?] were in 52 moves, but they required leaps parallel to the board edge." *PFCS* (vol.2 #6 Jun 1934 p.67, sol #7 Aug 1934 p.75) ¶1415 The root-29 leaper, {2,5} mover, may play a 42-move closed tour on the 7×8 board. FD gave all possible closed paths of the leaper up to 42 moves. The longest tour on the 7×7 board is the 32-move one.

Drach, S. M.; in *Philosophical Magazine* 1848. Footnote to Beverley's tour.

Duby, J. J. *Etude* #8 (IBM France, Paris, 22 October 1964) 'Un algorithme graphique trouvant tous les circuits Hamiltoniene d'un graphe'. In English with French subtitle and summary. Finds there are 9862 closed knight's tours on the 6×6 board. [Ref. from D. Singmaster 1987]

Ducommun, Chs: Les randonnees du cavalier: divertissement original pour les connaisseurs du jeu d'échecs: problèmes d'un genre particulier. Ducommun 1965. Étude des parcours du cavalier sur l'échiquier usuel par demi-echiquiers: calculs et schemas. Ducommun 1966. [K]

Dudeney, Henry Ernest (1857 April 10 Mayfield - 1930 Apr 23 Lewes) [but some sources give his birth as 1847 and death Apr 24]

Tribune, p.2-3 Oct 1906 and p.3 Dec 1906. Queen paths of 5 and 15 moves and Bishop path of 17 moves [cited in Rouse-Ball 1956 p.186-7]

Queen 12 Nov 1910. An open knight's tour of the 80-cell Greek Cross board was set as a puzzle. "We select ... one of the more elegant ways of solving this puzzle. Perfect symmetry is not possible, but our path approaches it." (The central 4×4 less two cells is based on a closed path with Sulian symmetry.) [cited by Bergholt 1916]

Amusements in Mathematics (Thomas Nelson & Sons London 1917 and numerous reprints, Dover editions 1958, and 1970) [My own copies] (a) Rook or wazir tours: ¶242 p.69, 198, 3×4 unicursal in 19 moves. ¶244, p.70, 198, 8×8 maximum length unicursal 16 moves, 70 units. ¶247, p.71, 199, 4×5 unicursal in 36 or 35 moves. ¶250, p.72–3, 200, 4×6 with trick of immediate return to visit the start square. ¶253, p.73–4, 201, formula (m+n)!/m!n! for number of shortest wazir paths corner to corner of m×n rectangle. ¶320-324, p.96–8, 223–5, 8×8, 16-move closed, 21 open, 57 longest, etc. (b) Bishop, Queen etc: ¶325, p.98, 225, bishop 17 moves. ¶328–333, p.98–101, 225–7, Queen 14 moves, citing Loyd 1868, two using Nightrider line, 12-move tour on 7×7, longest Q 5 moves from d1 without intersection: d1-h1-a8-h8-h2-c7 = 17 + 12 root 2 = 33.9705 whch is slightly longer than d1-h1-h8-a1-a8-g8 = 24 + 7 root 2 = 33.8995. (c) Knight: ¶243, p.79, 198, and ¶339, p.103, 229, these problems both use the unique quarterboard tour that solves Aladdin's Conundrum. ¶334–341, p.101–3, 227–230, two 7×7 tours, 12 corner-to-corner 4×5 tours, two equal circuits on 4×8, compartmental tour, tour of faces of 8×8×8 cube, the move from face to face being made as if the two formed a single 8×16 board (see Eschwege 1896), and the Guarini problem. (d) 'Mazes and how to thread them', p.127-137. Networks as button and string configurations.

Durand, (L'Abbé) — *La Régence* 'Géneralisation Complète du Problème d`Euler' (1856 p.366-372) Repeated with two diagrams in *La Nouvelle Régence* (1862 p.83-87, 117-120, 152-156) [L][M] This pretentiously titled article appears to contain nothing that isn't better treated by Collini (1773) and Roget (1840). It has no actual knight's tours! [online]

Durer, Albrecht: A 4×4 magic square is shown in Durer's *Melancholia* engravings of 1514.

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Easy Introduction ... to chess. (Philadelphia 1824). The Moivre tour. [L]

Echiquier, *L'* Chess magazine (1925-1939) edited by Edmond Lancel. Contributors include Errera, Dawson (1930), Godron, Kraitchik (1926), Marques, Pauly, Post, Tolmatchoff, Vatriquant.

Edinburgh Philosophical Journal 1821 and 1823 (vol.4 #8 art.30 p.393-398, and plate 10, facing p.393 and vol.9 #18 art.5 p.236-237, and plate 6, facing p.237). Reviews of Willis (1821) and of Kempelen's automaton. [Cited by Roget 1840] [OU shelfmark RSL: 1819–26 Per.1996 e.273.]

Egan, Pierce (1772-1849). *Sporting anecdotes ... delineation of the sporting world* (London 1820, and Philadelphia 1822). Has a four-star closed knight tour p.188 (US edition p.137) [C cites p.156] This source also includes an account p.245-250 (or p.177-181) of Kempelen's automaton recorded as appearing at Spring Gardens, London, 1819. [C] [online]

Eggleton, Roger B. and **Eid, Abdul** *Ars Combinatoria*, #17A, 1984 'Knight's Circuits and Tours' p.145-167. [From Institute of Combinatorics and its Applications, Winnipeg, Canada.]

Eid, Abdul: See Eggleton R. B.

Encyclopédie: 28 vols, including 11 of plates published during the period 1751–72. [now online] Denis Diderot (1713-1784) and Jean le Rond d'Alembert (1717-1783) were the main editors. Lucas (1882) cites this source as saying that a method of solution of the knight's problem on the usual board was known long ago ('tres anciennement') in India; and Kraitchik (1927, p.1)

says more specifically that they trace it to the Brahmins (Hindu priests) 2000 years ago, but they give no page reference. The article *Echecs* in vol.5 p.244-248 gives a survey of views then current on the history of chess, including for example the legend of Sissa, but nothing to quite justify these later assertions. They may be referring to the 1776 article by Monneron.

Engelhaupt, Hans. Gives a 10×10 tour with constant difference 10 in the solutions to the article 'Piece-Wise Symmetric Tours' in Problems and Conjectures 2304, *Journal of Recreational Mathematics*, vol 28 #1 p.63-64 1996/7 (solution vol 29 #1 p.69-71, 1998).

Eperson, Donald: *Patterns in Mathematics* Basil Blackwell Ltd (Oxford 1988 Ch.7 p.53–58, sols p.136–139) 'Knight's tours'. The introduction on p.53 gives two 8×8 closed tours (described as 'unicursal') in numerical and graphic forms. The first is symmetric with oblique quaternary elements, the second has near axial symmetry, and its central area is formed of the symmetric (4×4 – 2) tour. These are said to be constructed using the methods of Euler and de Moivre. There follows a series of six questions and nine problems involving knight's paths forming symmetric patterns on a 5×5 board. These are designed for use in primary schools and in remedial courses for students with 'mathophobia'.

Erlebach, Joachim: Editor of H. Schubert's *Mathematische Mussestunden* 11th edition 1953, 12th edition 1964, 13th edition 1967. See also Fitting.

Errera, Alfred (1886-1960) *L'Echiquier* #4 Apr 1925 p.83–4 (sol #7 Jul 1925 p.151). Tour in two shaped halves, not 4×8.

Eschwege, H. *The Knight's Tour. In a continuous and uninterrupted Ride over 48 Boards or 3072 Squares. Adapted from Byron's 'Mazeppa'.* Silsbury Brothers, Shanklin, Isle of Wight 1896. Dedicated to Sir George Newnes, Bart, President of the British Chess Club. [British Library shelfmark 11647 ee37, catalogued under Byron, G.G.N.] This is one of the oddest cryptotours, and certainly the longest. Byron's poem is presented on a series of chess boards, one word to a square, commencing at f8 and proceeding to e2, whence to leap to f8 on the next board, and so on. The same tour, supplied by H. E. Dudeney, is used throughout, except on the 48th board where it is modified to end at h1. (See p.529 for diagram.)

Essener Anzeiger 13 Apr 1926. An open unsymmetrical 10×10 tour [Murray 1942].

Euler, Leonhard (1707-1783):

'Solutio problematis ad geometriam situs pertinentis' *Cammentarii Academiae Scientarum Petropolitanae 1736* (St Petersburgh 1741 vol.8 p.128-140). This is the paper n the Konigsberg bridges problem.

Letter to Goldbach 1757 (see P. H. von Fuss 1843).

'Solution d'une Question Curieuse qui ne Paroit Soumise a Aucune Analyse' {Solution of a curious question which does not seem to have been subject to any analysis} *Mémoires de l'Academie Royale des Sciences et Belles Lettres, Année 1759* (Berlin 1766 vol.15 p.310-337). This paper is reproduced in collections of Euler's works: *Leonhardi Euleri Commentationes Arithmeticae Collectae* Academiai Imperialis Scientarium Petropolitanae, edited by P. H. von Fuss and N. von Fuss (1849 vol.1 p.337–355) and *Opera Omnia* (1923 vol.1 §7, p.26–56). [My source was a photocopy provided by the British Library.]

Exner, (Dr) Heinrich Gustav (b.1830) 'Der Rösselsprung als Zauberquadrat, Eine kombinatorische Aufgabe' *Progress, des Königlichen Gymnasium zu Hirschberg* (No.147 Easter 1876 p.3-28, Wilhelm Pfund Press, 41 pages) [A] [C] [K4091] Contains 15 magic tours of which three are new (27i) and (34a), (34e) which are the first to have the {3,4} end-point separation. [Five others of this type were found later by Ligondes (1883).] Also (34a) is the first to use only one pair of Beverley quartes. Another tour gives a fifth arithmetical version of Jaenisch's (00a). These are tours with consecutive quartes in the same quadrant. These are magic tours H15-18.

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Fabel, (Dr) Karl: See *Schach und Zahl* (1978).

Fairy Chess Review (1936-58) edited by T. R. Dawson until his death in 1951, and continued by Dennison Nixon and C. E. Kemp until 1958. Tour contributions by the editors and H. A. Adamson, Major J. Akenhead, Rev A. W. Baillie, H. D. Benjamin, E. W. Bennett, W. H. Cozens, H. H. Cross, Miss D. R. Dawson, H. E. de Vasa, R. J. French, G. Fuhlendorf, N. M. Gibbins, A. H. Haddy, S. H. Hall, F. Hansson, D. H. Hersom, E. Huber-Stockar, J. G. Ingram, W. Langstaff, A. Lapierre, G. Leathem, W. E. Lester, G. E. McGuffey, H. J. R. Murray, V. Onitiu, T. G. Pollard, W. H. Reilly, W. Stead, J. Sunyer, P. C. Taylor, P. B. van Dalfsen, O. E. Vinje, A. C. White, T. H. Willcocks. See also *Problemist Fairy Chess Supplement*.

Falkener, Edward (1814 Feb 28 London - 1896 Dec 17 Carmarthen):

Games Ancient and Oriental and How to Play Them, Longmans, Green and Co 1892. Reprint, Dover Publications, New York, 1961. [My own copy] Pages 267-356 deal with magic squares and knight's tours, including magic knight's tours p.319-336.

He says that Roget issued a card bearing a semi-magic tour of squares and diamonds type, overprinted with the pattern of 16 circuits and bearing the inscription 'Key to the Knight's Move as a Magic Square'. However the tour he shows is from Tomlinson (1845) and Falkener is the only source where this card is mentioned and he is not always reliable. In 1990 I enquired of the Royal Society if a copy exists among Roget's papers, but they could not help.

The magic tours quoted are Beverley's, one by Wenzelides, seven by Jaenisch (three of which he claims as his own), eight by Palamède (Ligondès), and the one by Caldwell. He gives a collection of 8×8 tours and tours of the four-handed chessboard with striking patterns.

Feisthamel, A. The editor of a series with the title 'Un Problème Par Jour' that begins in the French newspaper *Le Siècle* {The Age} on Monday 30 Oct 1876. The first knight's tour that appears is the solution to problem 4 on 2 Nov 1876 under the heading 'Polygraphie du Cavalier'. It is presented in the form of a cryptotour with two or three letters to a cell, which when read in the correct knight-move sequence spells out an acrostic verse whose solution is a 4×4 word square. Thus in effect three problems in one! The solution, together with another tour problem appears in the issue for 10 Nov 1876 and subsequent tours appear weekly. The series continued under Feisthamel's editorship until Problem 5656 on 30 Apr 1894, and then for a short while under Emile Franck. *Le Siècle* can now be accessed online through the Gallica (BnF) website.

Murray (1951) wrote: "A period of great activity in the composition of magic tours opened in France in 1880, largely stimulated by M[onsieur] A. Feisthamel in his chess column in *Le Siècle* 1876-1885, in which he published all the known magic tours and new ones as they were produced." A few however I could not locate there. Many tours also appeared in other French newspaper columns. Apart from A. Béligne (2 tours) and A. Feisthamel (1 tour) who used their own names the other contributors of tours adopted pseudonyms, which Murray identifies as: Adsum = Charles Bouvier, Célina = Edouard Francony, Paul de Hijo = Abbé Jolivald, Palamède = Count Ligondès of Orleans; X à Belfort = Prof C. E. Reuss. The only one of these actually identified by Feisthamel is Reuss whose first name he gives as Emil.

Feisthamel's own magic knight tour (14d) appeared in *Le Siècle* ¶2242 4/11 Jan 1884. It is set as a double tour problem, the first solution being the very similar tour (34f) by Ligondes.

Fischer, Alexander: 'New Records in Nonintersecting Knight Paths' *Games and Puzzles Journal* #45 (online) Sep-Dec 2006.

Fisher, John: *The Magic of Lewis Carroll* 1973. Various highly symmetric 8×8 tours.

Fitting, (Prof. Dr.) Friedrich (1862-1945); *Z. für Math. und Physik* (1900); *Weitere Beitrag zur verallgemeinerten Rösselsprungaufgabe* (Teubner 1901) [K4107]; *Archiv der Math. und Physik* (1902); *Das Rösselsprungproblem in Neuer Behandlung* (Lipsk 1904) [K4109]; Editor of H. Schubert's *Mathematische Mussesstunden* (4th edition 1924) §24 p.201-214 Hamiltonische Rundreisen. §25 p.215-245 Rösselsprünge. This has a new section quoting a figure of 10,298 for all tours on the 6×6 board, and describing the method of enumeration in relation to a board of 22 cells 4×5 with squares added at the middle of the odd sides. 6th ed 1940. 10th ed 1943. According to the MacTutor History of Mathematics "Friedrich Fitting is best known today for giving a proof, in 1931, that there are exactly 880 magic squares of order 4." [see Frénicle 1660].

"This result appears in his paper *Rein mathematische Behandlung des Problems der magischen Quadrate von 16 und von 64 Feldern*" See also Erlebach.

Florence. Italian ms (codex XXIV) c.1490 has a 4×8 tour [Lasa 1850 p.164, Linde 1874, 1881, Murray 1902.]

Flye Sainte-Marie, C.; See Sainte-Marie

Fontana, **Giorgio***, Opuscoli Matematici Supra il Teorema della Composizione delle Forze e Sopra il Calcolo Integrale delle Differenze Finite* (Pavia 1789 p. 45). Euler. [L]

Forbes, Duncan (1798 Apr 28 Kinnaird - 1868 Aug 17) Professor of Oriental Languages, King's College, London 1837–61; Catalogued British Museum Persian mss; *History of Chess* 1860. Contains a translation of the Ala'addin quarterboard tour problem. [Quoted in Falkener 1892]

Francony, Edouard pen name 'Mme Célina Fr'. A tour attributed to this author ¶730 in *Le Siècle* 7/14 Mar 1879 is the same as (12b) by Wenzelides 1850. He was also the author of a tour in *Le Telegraphe* mentioned by Feisthamel in *Le Siecle* 18 Aug 1882. My guess is that this was the Mysore tour (at that time not known in France). He found three magic tours in 1881 and three in 1882 according to Murray, (00c) (05f) (27k) and (05c) (05e) (23a), but I have not found where they were published, not found in *Le Siècle*. Also two tours (27l) and (27m) are the solutions to ¶1156 in *Gil Blas* 23 Feb / 2 Mar 1883. Also three other tours (12k) (00k) (12l) published as the three parts of ¶1582 in *Gil Blas* 10/17 May 1884. Murray gives earlier dates (1881-2) for most of these tours so they may have appeared earlier somewhere.

Franklin Journal and American Mechanics' Magazine Franklin Institute Philadelphia 1827 'Observations upon the Automaton Chess Player, now exhibiting in this city by Mr Maelzel, and upon various Automata and Androides' vol.3 p.125-131. 'The Knight's move in the Game of Chess' p.132-134. This shows the Moivre and Chevalier W. (called "Mr De W***") tours in arithmetical form, the latter numbered from two different cells. [C] [Google Books]

Franz, R.: 'Rösselsprung' *Schachzeitung* (vol.2, p.341-343, 1847). Closed asymmetric tours of squares and diamonds showing differences of 8 or 16 (cf F. P. H— 1825) in diametrally opposite squares. One quasimagic (files adding to 260, ranks to 260±4), the other demimagic (adding to 260±2 in rows and columns (cf Troupenas 1842). [A][M]

Fraser, Alexander: *The British Chess Magazine* (1911 vol.31 Dec p465) Monogram tours showing MD and ECC (for Edinburgh Chess Club), also mentions earlier examples in *Strand* magazine. *BCM* (1924 vol.44 p173) Monogram tours with NM (N. Munro) twice.

French, R. J. in *Problemist Fairy Chess Supplement* 1934; in *Fairy Chess Review* 1939, 1941.

Frénicle de Bessy, Bernard (c.1605-1675) was the first (c.1660) to list all 880 of the 4×4 diagonally magic squares. However the work was only published after his death in: *Des Carres Magiques, Divers Ouvrages de Mathem. et de Physique* (Par Messieurs de l'Academie Royale des Sciences de Paris 1693) p.423-507. Reprinted in: *Des Quarres ou Tables magiques*. Including: *Table Generale des Quarres Magiques de Quatre*, Memoirs de l'Academie Royal des Sciences, depius 1666 jusqu'a 1699, vol.5, p.209-354 (Paris 1729). A computer print-out of the list is given by Benson and Jacoby; they cite the reference: K. H. De Haas, *Frénicle's 880 Basic Magic Squares of 4x4 cells, Normalised, Indexed and Inventoried* D. Van Sijn & Zonen, Holland, no date given.

Frierson, L. S. 'A Mathematical Study of Magic Squares' *The Monist* 1907 #17 (2):272-293. 'A New Method for Making Magic Squares of an Odd Degree' *The Monist* 1909 #19 (3):441-450. 'Notes on Pandiagonal and Associated Magic Squares' *The Monist* 1911 #21 (1):141-152. 'Notes on the Construction of Magic Squares' [name given as C. S. Frierson] *The Monist* 1912 #22 (2):304-314. Also Ch.5 in Andrews *Magic Squares and Cubes* (1917).

Fritsche, Hugo: *Brett oder Rösselsprungspiel ...* {Board for knight's tour game} Patentschrift 179770, 4 Feb 1906 approved 18 Dec 1906. [C]

Frolow, Mikhail: *Le Problème d'Euler et les Carrés Magiques*, Nouvelle étude, suivie de Notes par Monsieurs H. Delannoy et Ed. Lucas. (Paris 1884) [A]; *Les Carrés Magiques*, Paris 1886. (a) p.21 Magic knight's tours by Feisthamel (14d) and 'Palamède' (= Wenzelides 12e). (b) p.33-4 Border braid method to expand 5×5 to 9×9, 6×6 to 10×10 etc, attributed to H. Delannoy. (c) Plate VII has 10×10 closed tours of {1,4} and {2,3} movers by A. H. Frost. [British Library].

Frost, Andrew Hollingworth (1819 Hull - 1907 Cambridge) *Quarterly Journal of Pure and Applied Mathematics* (London 1876 vol.14 #54 p.123-125 and plate 3 at end of volume) 'On the Knight's Path'. Construction of open tours on square boards of any size by compartmental and bordering methods. Also applied to tours in cubes and on the four-handed chessboard. *QJM* (1877 #56 p.354-359 and plate 5 at end of volume) 'A Simple Method of Tracing Paths of a Knight over the Squares of 5, 6, 7, 8 and their extension to higher squares' Improved examples of tours by bordering methods. Includes one 8×8 with diametrally opposite cells differing by 8. *QJM* (1878 #57) 'On Nasik Squares'. [C][O RSL: Math.Per.3] According to Bidev 1986 he "designated Panmagic squares Nasik after the town in India where he was working about 1850-60". *Encyclopaedia Britannica* 'Magic Squares' (1883); Also 10×10 closed tours of {1,4} and {2,3} movers in M. Frolow 1886.

Frost, Percival (1817-1898) *Quarterly Journal of Mathematics* 1876. Introduction to an article by his brother A. H. Frost.

Fuhlendorf, G. *Problemist Fairy Chess Supplement* (vol.1 #11 Apr 1932 p.64) ¶378 Dawsonian figured tour. *Fairy Chess Review* 1937 solutions to V. Onitiu problem ¶457 include a closed tour by G. F. with nine three-unit lines. (*Fairy Chess Review* vol.3 #8 Oct 1937 p.86) ¶2933 Squares in sequence on first rank (part solution of the G. E. Carpenter problem).

Fuss, N von and **Fuss, Paul Heinrich von**: *Leonhardi Euleri Commentationes Arithmeticae Colectae*, Academiai Imperialis Scientarium Petropolitanae vol.1 1849 p.337-355 (Euler 1759).

Fuss, Paul Heinrich von; *Correspondance Mathématique et Physique de Quelques Célèbres Géomètres du XVIIIème Siècle* Académie Impériale des Sciences de Saint Pétersbourg (vol.1 1843 p.654-5. Johnson reprint New York 1968 and online. Euler's letter to Goldbach 1757.

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Gaige, Jeremy (1927 Oct 9 - 2011 Feb 19) *Chess Personalia: A Biobibliography*, McFarland (1987). Source of some biographical details in this Bibliography.

Gardner, Martin (1914 Oct 21 Tulsa - 2010 May 22); *Scientific American* Oct 1967. Also (vol.220, #4, Apr 1969 p.125) The 6×6 noncrossing knight path from Yarbrough et al (1968). *Mathematical Circus* 1979 Uncrossed knight paths p.186-188.

Gasbarri, Giuseppe *Raccolta di Venticinque Nuovi Problemi di Scacchi* ... (Firenze, Tofani, 1836, p.17-20). This work discusses Euler, Vandermonde, Ciccolini and 'a recent German booklet' (probably Warnsdorf). The anonymous author is identified as Gasbarri in Chicco & Porreca (1971) and in the Cleveland Library catalogue. A tour from this source (quoted to me by Franco Pratesi in 1996) is very similar to Euler's first closed tour, and to one in Volpe (1766) incorporating an internal 3×4 tour. (See p.529.) [C]

Gendre, Le; see Legendre.

Geynet, A. *Comptes Rendus de l`Académie des Sciences* (Paris vol.60 1865 p.484) 'Mémoire Relatif au Problème du Cavalier' [M]

Ghersi, (Ing.) Italo: *Matematica Dilettevole e Curiosa* 2nd edition, Ulrico Hoepli, Milan 1921. Puzzle of shortest path between given points, via certain intermediate points in any order, p.64–6. Diagram of 8×8 H-shaped pseudotour, p.81. Knight's tours, p.74–85. The 3×3 magic square as a tour, p.319. Magic king tour, p.320 (Figs 261 and 265). Step-sidestep magic square tour of (0,1), (1,1), (1,4) moves, p.321 (Fig 262). [British Library]

Gianutio della Mantia, Orazio (known as Gianutio): *Libro nel quale si tratta della maniera di giuocar a Scacchi, con alcuni sottilissimi partiti, nuovamente composto* (Antonio de Bianchi, Torino 1597). One 4x8 tour. D. Singmaster notes the tour is not in the 1817 English translation by Sarratt. [Linde 1874 diagram 246; 1881, Murray 1902; 1913, p.727, 730; 1930]

Gibbins, Norman Martin (1882 Oct 15 Brighton -). *Mathematical Gazette* (May 1944 p.46) 'Chess in 3 and 4 dimensions'. Gives the smallest lattice for a knight's tour in space chess as 3×3×4 [surely a misprint for 2×3×4?] and credits 3×3×4 tour to E. Huber Stockar of Geneva [details from A. Kumar] Also in *Fairy Chess Review* 1944.

Gik, Evgeny Yakovlevich: *Matematika na Shakhmatnoy Doske* {Mathematics on the Chess Board} 1976; *Shakhmatnye Dosugi* {Chess at Leisure} 1979; *Zanimatel'nye Matematicheskie Igry* {Entertaining Mathematical Games} 1982; *Shakhmatny i Matematika* {Chess and Mathematics} 1983; Mainly compilations of well known results from Loyd, Lucas, Dudeney, Dawson etc.

Gilbert, Grove Karl (1843-1918): *Bulletin of the Philosophical Society of Washington* 10th meeting 30 Jan 1884 'The Problem of the Knight's Tour'. Abstract only. Discusses conditions under which various symmetries are possible. "It is determined empirically that the smallest square field on which the [closed] tour can be executed is that with 36 spots. Upon this field the number of possible tours with biradial symmetry is 21, of which 5 have also quadriradial symmetry." The correct total is 22 (Kraitchik 1927).

Gilpin, Michael Michigan Technological University, USA (1997) Independent confirmation of T. W. Marlow 1987 enumeration of reguar magic tours, using more powerful computer methods.

Gizycki, Jerzy 1987. See *Szachy od A do Z* 1987.

Glasgow Weekly Herald 1873-74. A series of 'Knightly Peripatetics' appear in a column edited by 'E. H—' (full name unknown). For example Knightly Peripatetic VI (Mar 22 1873) is a symmetric squares and diamonds tour (bg=), which also appears in Falkener 1892 though rotated 90°, so maybe from an earlier source. When numbered from e1 to c2 the diagonals add to 520, and the diagonals of the middle 4×4 add to 260; and related magic properties. Several of the Knightly Peripatetics are 'magic two-knight tours' in quaternary symmetry with connecting rook moves. These examples pre-date those known to Murray. [British Newspaper Library, Colindale]
'The chess and draughts column of The Glasgow Weekly Herald (1872-1902)' by J. Jenkins and R. McCoy, 12 vols (cuttings?), is a reference I have noted but not located. David Forsyth (1854-1909), inventor of the Forsyth notation for communicating chess positions without diagrams, was a later editor of the chess column (c.1883).

Glaszer, (Prof.) Christian Flamin Heinrich August *Jahresbericht von der königl. Studienanstalt zu Erlangen in Mittelfranken* (28 Aug 1841) 'Abhandlung über dem Gang eines Springers auf dem Schachbretts' Also cited as Glasser 1844. [K4075] Describes the methods of Euler and Vandermonde and gives an irregular closed tour by his late colleague Prof. Rothe, constructed by Euler's method. Murray (1930) calls this "Horrible!" because of its high irregularity. See the Asymmetry section (p.456) and Symmetrisation (p.479).

Glinski, Wladislaw (c.1920 - Feb 1990). He is said to have invented his version of Hexagonal Chess in 1936, but it only became popularised in English in the 1970s. *Rules of Hexagonal Chess with Examples* 1973, *First Theories of Hexagonal Chess* 1974.

***Globe, De**; Album van Buitenlandsche Lettervruchten* 'Merkwaardigheden betreffende het schaakspel' (De gebroeders Abrahams, Middelburg,1866). [C]

Godron, —: tours on small shaped boards, See *L'Echiquier* 1928-9.

Golomb, Solomon Wolf (1932 May 30 - 2016 May 1); *Journal of Recreational Mathematics* 1968. Ascribes 45 degree knight - camel transform to Lloyd R. Welch (but see T. R. Dawson 1930s). Also p.309-310 1993.

Gorgias, Victor: *Westminster Papers* 1871 Frontispiece to vol.3 'The Knight's Tour on the Board Used in Chess for Four Players' A 160 cell open tour. This tour is described as 'a figure of the greatest beauty and regularity' and the author as Victor Gorgias 'of Oëdenberg' [details from K. Whyld] The text on p.87-88 by the editors includes two 8×8 tours. These are the semi-magic 'Roget Card tour' from Tomlinson (1845) and the magic tour (12n) from Jaenisch (1859). *Gentleman's Journal (An Illustrated Magazine of Literature, Information and Amusement)* London Aug 1871, in the chess column edited by Heinrich Meyer, 'The Knight's Tour' p.124-5, 196. Open tours of 8×8 board in near-biaxial symmetry [M] also king tour (?). *Dubuque Chess Journal*, several issues 1871. Three open tours of 8×12 board in near-biaxial symmetry. [M]

Goulieux, (Mlle.) Stella: *La Strategie* (1899 vol.32 p.114). Letter 'M' Tour. [note from D. Pritchard]. See also Maczuskie.

Grandin, (Prof. Collège de Navarre): Editor of editions of Ozanam *Recreations* 1820, 1825, 1835.

Graph Theory with Applications by J. A. Bondy and U. S. R. Murty (Macmillan 1977, p.53–4). Theorem 4.2. My source for Euler's unicursal theorem and Kuratowski's planarity theorem.

Grimstone, Clive J. (1950 Sep 24 London – 1986 Apr 21 London) *Chessics* (#15 1983 p.4) Lettered tour on RP board (joining each pair of opposite sides, but with a Mobius twist) spelling CHESSICS on diagonal. KTN Website, 'Ant' (alternating King) tours on 8×8 (sent to me 30 April 1983). *Chessics* (#24 Winter 1985 p.85, 100) Mathematics of Wizard pattern. (#27 Autumn 1986 p.135) Obituary.

Grossetaite, E. *Figaro* 1896. An 8×8 magic knight's tour (01e). The final 8×8 magic knight tour to be discovered in the 19th century, 84th in the historical sequence. [M]

Guardian, The Notes & Queries, 13 and 20 Jan 1992 (on sentences in various languages that use very few different letters).

Guarini di Forli, Paulo (aka Paulus Guarinus) (died 1520): ms 1512 ms in the J. G. White collection, Cleveland Library, Ohio, USA, contains the Civis Bononiae 4×8 tour. His diagram shows the Nicolai tour (f) traversed in reverse sequence, with a knight at the top right corner and the successive squares lettered a to p (no j) and A to Q (no J) in two type styles showing the two-part structure of the tour. Also includes the knight interchange problem on the 3×3 board.

Gullberg, Jan: *Mathematics from the Birth of Numbers* W. W. Norton & Co, New York 1997. Three magic knight's tours, and one magic two-knight's tour, are quoted on p.209 in §5.6 (p.205–214) on 'Magic Squares and Their Kin'. The first is Beverley's tour (27a, reflected in the principal diagonal) but misattributed to Euler. The two-magic tour is by Feisthamel (source not given) its middle link is a {0,3} move f4-c4. The other two magic knight tours are by Jaenisch (00a and 12o) though the second of these is misattributed to Wenzelides.

Guyot, Edmé Gilles: *Nouvelles Récréations Physiques et Mathématiques* ... 4 vols, Chez Gueffier, Paris 1769–1770. Tours in vol.2, 1769, p.230-242 (recreation 60) and plate 2 (Moivre tour). Later editions: 1772–75, 1786, 1798, 1799, 1800–01; German edition: *Neue physikalische und mathematische Belustigungen* ... Augsburg, 1772 [A]; Italian edition: *Giuochi fisici e matematici i Piu Belli Finora Immaginati* ..., l`Erede Pazzoni, Mantova, 2 vols, 1817–18, vol.2, p.98–115, Giuoco 31. Edited by Teofrasto Cerchi. Also 1881. [A] [C]

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H—, E. (name unknown). Editor of column 1873-4 in *Glasgow Weekly Herald* (See entry in G).

H—, F. P. Appendix to *Studies of Chess*, London, 6th edition 1825 p.533-536 [photocopy kindly provided to me by M. Sheehan] This appendix is not in the 5th edition 1817. This work is an English version (usually attributed to Peter Pratt) of *L'analyse du jeu des Echecs* by the famous chess player (and musician) François-André Danican Philidor (1726-95), which first appeared in 1749 and in English translation in 1750. Three tours. See Squares and Diamonds p.336.

Haberlandt, Michael (1860-1940). *Der Altindische Geist* ... (1887 p.161) 'Der Rösselsprung' [Google Books - has contents list only]

Haddy, Albert H. (1900 - 1971 Dec 24) *Problemist Fairy Chess Supplement* (vol.1 #12 Jun 1932 p.73, #13 Aug 1932 p.81, #14 Oct 1932 p.89, #15 Dec 1932 p.97, #16 Feb 1933 p.105) ¶449 ¶490-1 ¶564-5 ¶605-6 ¶658-9 Dawsonian figured tours. *Fairy Chess Review* (Feb 1944 p.74, Apr 1944 p.85, Aug 1944 p.101) ¶5817 ¶6095 54-move antelope paths.

Hakim, Abu Zakariya Yahya ben Ibrahim, al-; ms c.1330, *Nuzhat al-arbab al-'aqulfi'sh-shatranj al-manqul* {The delight of the intelligent, a description of chess}. This has two 8×8 tours, one attributed to al-Adli and the other to Ali ibn Mani. It survives in two mss, one scribed about 1330 has both tours, a later copy has only one. [Murray 1913, p.175–6, 336]

Haldeman, Samuel Stehman (1812 - 1880) *Prodromus: Bibliography of the Chess Knight's Tour* E. H. Butler & Co Philadelphia 1864 [C] *Tours of a Chess Knight* E. H. Butler & Co Phladelphia 1864 [C] [K4082] [online] This consists mainly of a collection of 108 tours on 8×8, but incidentally includes a 3×8 tour and the third 5×6 tour. Tours 55-90 and 101 are symmetric.

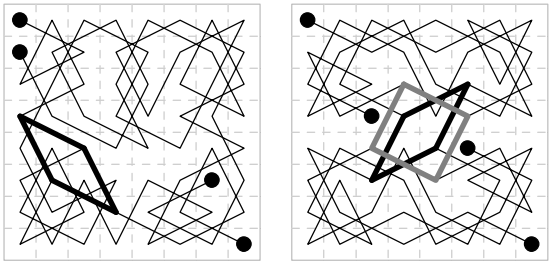
Hall, (Dr) Sidney Herbert (1871 Jul 4 Carlisle - 1947 Dec 23 Brentwood) *Problemist Fairy Chess Supplement* (vol.2 #10 Feb 1935 p.108, sol #11 Apr 1935 p.117) ¶1705 Square numbers in a ring round the centre. (#16 Feb 1936 with Dawson p.172, sols #17 Apr 1936 p.182) ¶2178-9 tour with multiples of 7 in a 3×3 array, and tour with eighteen odd primes in a rectangle. *Fairy Chess Review* (vol.3 #8 Oct 1937 p.87 and #9 Dec 1937 p.99) ¶2934-5 ¶3037-8 An alternative set of solutions to the Carpenter (1881) figured tour problem. In the 4th rank example the move segments are successively above and below the line. (#13 Aug 1938 p.140) ¶3249 tour numbered 0-63, with multiples of 7 in 3×3.

Hamilton, (Sir) William Rowan (1805 Aug 4 Dublin - 1865 Sep 2): *The Mathematical Papers of Sir William Rowan Hamilton*, editors H. Halberstam and R. E. Ingram (Cambridge 1931 vol.3 p.612–625) Letter to J. T. Graves (17 Oct 1856). Concerns a game on the edges of a polyhedron [cited by Bondy and Murty *Theory of Graphs* 1976] *British Association Report, Notices and Abstracts* (1857 p.3) 'On the Icosian Calculus'. Formal treatment of the same. [A] This article gave rise to the term 'Hamiltonian cycle' for a closed tour in Graph Theory.

Hansson, Frans (1887 Sep 25 - 1968 Aug 28 Gothenburg) *Problemist Fairy Chess Supplement* (vol.1 #14 Oct 1932 p.88, sol #15 Dec 1932 p.97) ¶535 'The PFS in the Desert' a long tale involving a Camel (alias Cnight) tour. (#17 Apr 1933, p.112-3, sols #18 Jun 1933 p.125) 'Adventures of the Cnight' another long tale, ¶714 asks for a symmetric camel tour on 8×8 cylinder with two 7-unit lines, ¶715 asks for the four possible symmetric camel tours on the normal 8×8 board. (vol.2 #8 Oct 1934p.81, sol #9 Dec 1934 p.93) ¶1512 camel tour. *Fairy Chess Review* vol.3 #10 Feb 1938 p110, #11 Apr 1938 p.120, #12 Jun 1938 p.130) ¶3108 ¶3180 ¶3251 Knight tours with Squares and Cubes in closed chains, cube path centred on board. [1940, 45, 48. Obituary in *Stella Polaris*.].

Hanstein, Wilhelm (1811-1850): 'Der Rösselsprung in höchster Kunstvollendung' {The Knight's Tour in its Utmost Perfection} *Schachzeitung*, v.4 1849 p.94–97. Encomium on Wenzelides' first symmetric magic tour, signed 'Hn'. [copy from M. Stere, now also online]

Harikrishna (also known as **Pandit Harikrishna Sharma Jyotishacharya**): ms *Kridakausalyam* 1871. The tours constructed by the Rajah of Mysore were preserved in this manuscript work. The knight's tour section is reproduced in S. R. Iyer *Indian Chess* 1982. Iyer notes: "The author of the present work is one Harikrishna, son of Venkataraman, who lived in Aurangabad in the Maharastra State. He wrote it in Saka 1793 (1871). These particulars are mentioned by the author himself in the last 5 verses of *Kridakausalyam*, which contains 700 verses in all. Harikrishna compiled a voluminous (encyclopedic) work [title in Indian script] which consists of six parts called Skandhas. Each part consists of several chapters, *Kridakausalyam* being the 20th chapter in the 6th part of that work. This chapter treats in 12 main sections of many indoor and outdoor games prevalent in his part of the country. The extract printed here [on chess and knight's tours] forms the 8th section. This book was printed in Devanagari script by Venkateshwar Steam Press, Bombay, in Saka 1822 (1900)." Tours 77-79 in the collection are the three versions of the one tour from Nilakantha (1640).



Tours 80-82 are Harikrishna's own. #80 and #81are 'two-horse movements' on the 8×8 board. In each case the horses start in the corners and on cell 6 have two choices of cell 7, leading to two separate end-points. In #81, which is in fact the Rudrata tour on the upper half together with a rotated version of the same on the lower half, there are two ambiguities 6-7 and 13-14. #82 is a conventional 'fillet and field' open tour on the 10×10 board.

Haughton, H. *The Chatto Book of Nonsense Poetry*, Chatto & Windus (London 1988 p.274-5 and 511) quotes a French cryptotour from Canel (1867).

Héraud, Auguste (1832-1885); *Jeux et Récréations Scientifiques* ... 1884, 1893. 'Marche du Cavalier' p.607 in 1893 edition [Google Books snippet]

Herma, A.: *Rösselsprünge aus deutsche Dichtern*: *Auflösungen* {Knight's tours from the German Poets. With solutions.} Frankfurt 1849?, 1889 64 pages. Appears to consist of poems presented in the form of knight cryptotours. [C] See also Leipzig (1845), *Illustrierte Zeitung* 1852, Lauber 1877. According to Google Books, New York Library has *Illustrirter familienschatz: ein universum für die deutsche familie*, vol.14, part 2 (Verlag des Illustrirten Familienschatz, 1889) which has a section with the same title. The Google snippets show part of a cryptotour.

Hersom, D. H. in *Fairy Chess Review* 1932, camel tour on cylinder, alternative solution to problem 714 by Frans Hansson.

Hertzsprung, S. *Brentano's Chess Monthly* (#5 Sep 1881 p.248-249): Letter from Copenhagen dated 17 July 1881 gives four solutions of G. E. Carpenter's problem with the square numbers in order of magnitude along the first, second, third and fourth ranks. He also calculates the number of ways of arranging the square numbers along the ranks. (See Figured Tours section p.417.)

Hijo, Paul de: (pen name of the Abbé Philippe Jolivald): See Jolivald.

Hoffmann, (Prof.) Louis (pen name of Rev. Angelo John Lewis); *Puzzles Old and New* Frederick Warne & Co London 1893. Reprint 1988 by Martin Breese Ltd. Knight's Tour Letter and Word Puzzles p.248-50 (sol p.259-63), partial tours and one near axially symmetric. The Knight's Tour p.335-6 (8 sols p.367-73), 2 by Euler, 1 'Du Malabar', 1 Monneron (= Nilakant-ha). 3 with near direct quaternary symmetry and 1 closed tour using Warnsdorf method. [My own copy 1988 edn]

Hofmann, Fritz: *Nouvelles Annales de Mathématiques: Journal des Candidats aux Ecoles Polytechnique et Normale* (3rd series, vol.15 1886 p.224–6) 'Sur la Marche du Cavalier'. Longwinded 'proof' that closed tour requires even number of moves. [LU shelfmark MA.PER.510.N9080]

Hofmann, Joseph Ehrenfried (1900-1973) *Elemente der Mathematik*. 1988 'Uber Rösselringe auf dem Brett von 6^2 Zellen' (edited by C. J. Scriba).

Hogarth, **William** (1696-1764) *The Analysis of Beauty* (1753) advocate of the serpentine 'line of beauty' in artistic design. (See the comments by Bergholt in the section on Symmetry p.26.)

Hogrefe, (Dr) Max: *Weser Zeitung* 13 July 1924. The first open tour with ten three-unit lines. e1-h7, f8-c2, a5-g2, f7-c1, a2-d8, b8-h5, b6-h3, g1-a4, f2-c8, e7-h1.

Hone, William *The Year Book of Daily Recreations and Information* (William Tegg London 1832). 'The Knight's Leaps' p.288-290, signed 'W'. It seems probable that the author of the article is George Walker (mainly because he was the only W active in the subject at the time). This has five closed tours. (See Asymmetry p.455 for diagrams of #3 and #4 and Symmety p.518 for tour #5 which is a double- halfboard tour [details kindly provided by Mike Pennell].

Honsberger, Ross 'Pòsa's Solution' *Mathematical Gems* 1973 p.145.

Hooghe, G. d': *Les Secrets du Cavalier*, *Le Problème d'Euler* Brussels 1962 includes a 16×16 diagonal magic tour by H. E. de Vasa. Reproduces incorrect count of 3×8 tours from Kraitchik.

Hooper, David Vincent (1915-1998) See *Oxford Companion to Chess* 1984.

Houston, Alasdair Iain (1952 Apr 17 Dingwall -) *Chessics* (#2 Jul 1976) Suggested the name 'antelope' for {3,4} leaper (vol.2 #24 Winter 1985 p.96-7) 'Houston's Problem' proposed to members of the Fairy Chess Correspondence Circle in the 1970s: How few moves by {r,s} leaper to make {0,1} journey?.

Huber-Stockar, Emil (1865-1939, railway electrification engineer): *Congres Internationale de Recreation Mathematique* 1935 p.79-92 (ed. M. Kraitchik) article on tours by compound pieces with moves in given directions (T. R. Dawson *FCR* Feb 1936 p.174 wrote: "a really remarkable study on partially generalised knights and their tours".

Tours 4×6 p.90 and 11×23 p.91 using moves in four directions Series of tours published posthumously: *Fairy Chess Review* (vol.5 #16 Feb 1945 p.124, sol #17 Apr 1945 p.134) ¶6304 unique giraffe {1,4} closed tour on 9×10 board, the smallest possible. *British Chess Magazine* (1945 vol.65 p.180, sol p.227-8) ¶6781 a Greek cross tour e1-d3-b2-a4- c5-b7-d8-e6-g7-h5-f4-g2.

Hunter, J. A. H. in *Journal of Recreatonal Mathematics* 1969. See also *Mathematical Diversions* (1963).

Hutton, Charles (1737 Aug 14 Newcastle upon Tyne - 1823 Jan 27 Charlton). Professor of Mathematics, Royal Academy Woolwich 1773. Editor of *Recreations in Mathematics ...*, 1803, 1814. English editions of Ozanam. [C]

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Illustrierte Zeitung 1852 Start of a series of cryptotours on the 160-cell Four Handed Chess board. Photocopies of cuttings in the J. G. White collection showing 10 such tours were sent to me by Cleveland Public Library (Ohio, USA). Unfortunately the hand-written publication details are difficult to read with any certainty. The last is dated August 1863.

Indian Chess History *570 AD - 2010 AD* (2013) by Manuel Aaron and Vijay D. Pandit. 'Knight's Tour' p.207-208, 'Krishnaraja Wodeyar III ' p.216-218. [My own copy from A. Kumar, now in the ECF National Chess Library, Battle.]

Ingram, J. G.: in *Fairy Chess Review* 1939.

Inwards, R. [biographical details unknown] undated ms in Koninklijke Bibliotheek 1925/1928?, with letter by T. R. Dawson [K4063]. Two albums with hand-drawn knight tours (all 8×8 symmetric on a page of 20 I have seen).

Irwin, A. M. B. *Notes & Queries* 1919. A reference not found. See Brown, J. W.

Iyer, L. R. Ramachandra in *Indian Antiquary* 1923.Review of Naidu?

Iyer, S. R. *Indian Chess* Nag Publishers, Delhi 1982. Reproduces the chess section fom Harikrishna Sharma 1871 containing tours by the (Maha) Rajah of Mysore, Krishnaraja Wodeyar. The text relating to tours is section 9 (p.29-47) with 82 diagrams in a 61-page appendix. See Mysore.

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Jackson, D. E.; in *Journal of Recreational Mathematics* (vol.25 #1 1993 p.70). Solves problem of E. W. Collins for tour with minimum diagonal sum 64 (i.e. first eight odd numbers on diagonal).

Jacobi, H. *Zeitschrift der Morgenländischen Gesellschaft* (Leipzig, vol.1 1896 p.227–233) 'Uber zwei ältere Erwähnungen des Schachspiels in der Sanskrit-Litteratur'. Rudrata (c.900). [Murray 1913 p.21-22, 53-55]

Jacobs, W. in *Problemist Fairy Chess Supplement* 1933.Initiated a series of 'i'-Point Problems in *PFCS* (Apr 1934 to Apr 1936) concerning moves connecting points at integral distance from the origin on unlimited boards. ¶1298 by W. Jacobs is the first problem though wrongly stated ¶1355 A. H. Haddy ¶1455-6 F. Hansson ¶1557-8 T. R.Dawson ¶1559 J. Sunyer (said to be an extension of a question by C. E. Kemp in the *Chess Amateur*). ¶1608-9 TRD ¶1610-11 JS. ¶1687-8 TRD. ¶1788 William Henry Reilly (b.1892 Oct 5 Salford, a founder member of the BCPS). ¶1850 FH. ¶1988 FH ¶2025 FH. ¶2180 FH. These are of mathematical interest but strictly speaking somewhat beyond our remit here.

Jacoby, Oswald: See *New Recreations with Magic Squares* (1976).

Jaenisch, Carl Friedrich Andreyevich (1813 - 1872 Mar 17 St Petersburg) also known as de or von Jaenisch or, in a different transliteration from Russian, as Yanich. He describes himself as 'Ex-professeur-adjoint de Mécanique a l'Institut des voies de communication'.

An obituary in Staunton's column in *Illustrated London News* (1872) notes that he left his books to the public library at Helsingffors in Finland. He is the fourth composer of magic knight tours.

Chess Monthly April, May and June (1859 p.110–115, 146–151, 176–179). 'De la solution la plus parfaite du problème du cavalier' and 'Solution of the problem of the knight's tour'. The same article in French and English on facing pages, dated Nov 1858, published over three issues. A preview of his forthcoming treatise (1862). These articles contain two new symmetric magic knight tours of rhombic type (12o) and (12n), plus the tour (12b) by Wenzelides from *Schachzeitung* 1850. The tours are given in numerical form on pages 150-151, and the reverse tours are given on pages 176-177 but inverted.

Traité des Applications de l'Analyse Mathématique au Jeu des Echecs, St-Pétersbourg (3 vols 1862, 1862, 1863) [K4081] [Cambridge University Library has a copy, three volumes bound as one. I was allowed a ticket to see this copy one afternoon in 1985, so my perusal had to be rather quick. As I returned the book to the desk the cover fell off, so I've been reluctant to return in case my name is blacklisted! [Text now in Google Books, but the page links only work for Vol.1].

Vol.1 (§1-79) deals with moves and powers of the various pieces. p.229 gives charts of the least number of moves by knight from a1 to each other square, and of the number of shortest routes; Fig.6 is a tour with constant diametral diference 16.

Vol.2 (§80-176) 'Problème du Cavalier'. This begins with a discussion of symmetries and shows the impossibility of direct (i.e. axial) symmetry in 8×8 tours. Then follow accounts of the methods of Vandermonde, Euler, Warnsdorf, Collini, Squares and Diamonds (citing Troupenas) and Magic tours. He uses the fractional notation of Vandermonde but in the form x/y instead of y/x which reflects paths in the a1-h8 diagonal. He suggests the (very high) figure 168C63 (the number of ways 63 moves can be chosen from the 168 possible) as an upper limit on the number of 8×8 tours possible. He shows particular interest in a type of arithmo-geometric tour consisting of four closed circuits joined to make a tour by deletion of one move from each. This results in the numbers 1, 16, 17, 32, 33, 48, 49, 64 (marking the start and end of the four circuits) forming a chain of knight moves. The positions of these eight numbers are often indicative of the structure in any 8×8 tours. The first four use the same circuits as Vandermonde (1771) though the diagram is rotated 90 degrees. He also considers tours on the 4×8 board, mainly of squares and diamonds type, and how to combine two together to cover the 8×8 board in an open tour or symmetrically. He diagrams a few tours on boards other than the 8×8 but most of these are from Euler (1759). Tours 5×8, 5×10, 6×6, 7×7, 7×9 appear to be new. His 6×6 tour described as three-times reentrant is one of the two with mixed quaternary symmetry.

Diagrams of magic tours begin in Vol.2 on p.104 with Wenzelides. The two magic tours of quartes type shown by Jaenisch in 1859 are reproduced in numerical form on p.107-8. Besides these the work contains a further four magic tours: 27c, 27d of Beverley type, and 00a, 00e of cyclic type. These are magic tours 11-14 in the historical sequence. The 13 known to Jaenisch are also diagrammed as Figures 25-32, 49, 53-56, 62 on the plates (28 and 29 both being 00m by Wenzelides).

Tour (00a) Fig.49 has diametrally opposite cells differing by 8, and is especially interesting since it is magic when numbered from ten different origins, the most ever achieved. Jaenisch in fact only shows four pairs of magic numberings (in the eight figures on p.178-179 and Fig 49). The fifth pair was noted by Exner (1876). All have sum of diagonals 520. Tour (00e) Fig.62 has Beverley quartes in opposite quarters, as do two by Wenzelides. The eight figures on p.235-6 are the numberings of (00e). The tours (27c) Fig.55 and (27d) Fig.56 are of Beverley type. Shown p.187 numbered from c1 as 1. (27d) employs four pairs of Beverley quartes. The numbers 1, 16, 17, 32, 33, 48, 49, 64 marking the ends of quarters of a tour can also appear in other formations than a knight circuit. In the tour (§90 p.28) they circle round the centre in a circuit of alternating knight and wazir moves. This tour is demi-magic: four ranks and files add to 252 and the other four add to 268.

Vol.3 (§177-284) 'De la Réaction des pièces de l'echiquier' is more about chess problems.

Reviews of this work appeared in numerous periodicals. One by Lasa in *Schachzeitung* vol.17 1862 p.65-69. Others appeared in: — *Cosmos: Revue Encyclopédique* ... vol.20 1862 p.282, 358-360 with magic tour 12o [C] — *Bulletin de l`Académie Imperiale des Sciences de Saint-Pétersbourg* vol.6 1862 p.473-477 [L] — *Mélanges Mathématiques* ... vol.3 1862 p.488-492 [L] — *Comptes Rendus de l'Academie des Sciences* Paris vol.54 1862 p.464 [L] — *La Régence* vol.3 1862 p.193-195 [L]

Janot, Denis (printer); A 4×8 tour the same as Civis Bononiae and Guarini. is the first tour to appear in a printed work. *Sensuit Jeux Partis des Eschez: Composez nouvellement Pour recréer tous nobles cueurs et pour eviter oysiveté a ceulx qui ont voulenté: desir et affection de le scavoir et aprendre et est appelé ce Livre, le jeu des Princes et Damoisellles*, printed in Paris between 1530 and 1540. [Vienna Library MUS II #195] [A] [M] [D. Singmaster]

Jelliss, George Peter (1940 Feb 8, Woolwich).

Chessics vol.1 (#1 Mar 1976 p.2) 'Angles in Knight's Paths' includes right angle theorem, missile puzzle: (#2 Jul 1876 p.2) 'The Five Free Leapers' {0,1} wazir, {1,2} knight, {1,3} camel, {2,3} zebra, {1,4} giraffe, {3,4} antelope, and conditions for {m,n} leaper to be free on h×h board are: (a) 2n ≤ h, (b) m+n odd, (c) m and n coprime. Proof that closed 8×8 Giraffe tour impossible; (#3 May 1977 p.5). Proves every closed 8×8 tour contains (a) an orthogonal angle, (b) an obtuse angle, and (c) four different angles. (#5 Jul 1978 p.4-5, 7-8) Tours with max and min angles. Proof of the four-angle theorem. Missile solution. Lettered open tour E-Z&A-Z&A-N spelling out KNIGHT TOUR. Symmetric figured tour with octuples on diagonal. Symmetric fiveleaper tour with 32 moves {0,5} and 32 moves {3,4}. See Lettered Tours.

(#6 Aug 1978 p.4-5) leaper tours with max symmetry. (#7 Mar 1979 p.3-5, 7, 10) 'Honeycomb Leapers' with five hex-knight tours on 91-cell board. 'Diffractional Tours' by fers, knight and alfil that reflect as if point-particles. More max angle tours. (#8 Oct 1979 p.9, 10-11) Onitiu (1932) tours with max straights. 'Eccentric Knights' restricted to edge-centre moves. (#9 Oct 1980 p.4, 8-9) honeycomb correction. Longest zebra, antelope and giraffe paths 8×8 and nonintersecting paths. (#10 Dec 1980 p.5, 7) zebra and giraffe max paths. 'Einsteiners': 'clockword mouse' and progressive leaper puzzles. (#11 Jan-Jun 1981 p.1, 7-9, 11) Honeycomb 7-leaper tours. Mobility calculations. Einsteiner solutions. (#12 Jul-Dec 1981 7-9, 12-13, 16) 'Missiles in Orbit'. min and max routes and cycles. 'Rook around the Rocks' with proof. Pick's theorem and Dawson progressive leaper tour. (#13 Jan-Jun 1982 12-13) 'Chessics and the I Ching' relates hexagrams to 'hyperwazir' moves. (#14 Jul-Dec 1982 p.1, 13, 16) The chessboard as 6D hypercube, tours of cube edge, and augmented wazirs. 'Progressive Leapers'. (#15 1983 p.4) Lettered tour Q-Z spelling out CHESSAYS on top rank.

Chessics vol.2 (#18 Summer 1984 p.22) 'Alternating Tours'.

(#19 Autumn 1984 p.25-27, 30-31) 'Intersections in Knight Tours' twelve tours with 7-fold-intersected moves, corner 6V formation, and unintersected moves. 'Chess and Things Binary' relates the Ring of Linked Rings puzzle to a hyperwazir tour.

(#20 Winter 1984 p.37-38, 48) Crosspatch patterns. (#21 Spring 1985 p.49-50, 56, 60) Crosspatch tours, 'Wazir Tours with Squares in a Row' unique 6×6 solution.

(#22 Summer 1985 p.61-72) Special Issue 'Notes on the Knight's Tour'. Figured tours: unique 6×6 tour with squares-in-a-row, and 8×8 with squares in wazir and giraffe circuits, and cubes in the corners. 'Origin of the Knight's Tour' nine historic examples. 'Ala'addin's Conundrum' the quarter-board and derived tours. 'Symmetry and Counting of Tours'. 'Small Boards' and 3×n results, count of 104 on 3×8. 'Knight's Tour as Conjuring Trick'. 'Lettered Tours': knights interchange and ambiguous routes. 'Cryptotours': 9×9 with Omar Khayyam verse. Tours 4×n. 5×n and 6×6. 'Synthetic Tours' Warnsdorf plus rules. Tours 10×10 one without right angles. 'Square-Symmetric Pseudotours' 30, 3 missing.

(#24 Winter 1985 p.85-100). Wizard. Leapers, Mobility patterns. Journeys. Fixed Distance Leapers, including tour by Root 65 on 14×14. Freedom. Amphibians. Houston's shortest path problem. Pterodactyl {3,3}+{5,5}+{0,15} tour 16×16. Verse Tours after Rudrata. Wizard leaps {r,s} with no common factor.

(#25 Spring 1986 p.106-7). 'Further Notes on the Knight's Tour' Three new figured tours: squares in a symmetric knight chain with axis of symmetry an axis of the board, squares and diamonds tour with octagonal numbers 1, 8, 21, 40 in the corners, squares in a knight path delineating a tour of the edges of a cube. Three pseudotours omitted from #22, and derive tours. More on Early History of Knight's Tours.

(#26 Summer 1986 p.113-128). Special Issue 'Magic Tours' produced after studying Murray's 26 boxes of papers in the Bodleian Library. Covers work of de Vasa and Willcocks, 48×48 and 12×12 diamagic knight tours. Concepts of magic. Magic tours on 2, 3 and 4 rank boards. Magic tours 3×5 using four types of move. Diagonally magic king and queen tours. Catalogue of 8×8 Magic Knight Tours. The tours are classified by a two-digit code based on the separation of the end-points: closed tours being coded 12 and cyclic closed tours 00. (One tour diagram 03b given in the catalogue was not in fact magic.) The description of the methods of construction concluded "It should be possible to apply modern computer methods to ascertain whether all the magic 8×8 knight tours of this type [i.e. using regular quartes] have been discovered." This was taken up by T. W. Marlow (1988). (#29+30 1987 final issue p.159-160, 163). Notes on #22, with further on enumeration of 6×6 tours and #26 king and queen tours.

Figured Tours: A Mathematical Recreation 1997, a 22-page A4 booklet containing more than 225 tours, including all 100 Dawson tours showing square numbers in knight chains.

Games and Puzzles Journal vol.1 #3 1988 'Sopwith manoeuvres' (directed wazirs on honeycomb) p.45 (solutions #4 p.61); #11 1989 'Chess Lettering' (delineated by knight circuits) and 'Figured Wazir Tours' (4×4) p.178.

Games and Puzzles Journal vol.2, #13 May 1996 Figured tour with Fibonacci numbers p.201, 'Knight's Tour News' on unpublished mss p.208 (followed by tours from Bergholt mss).

#14 Dec 1996 The Rajah of Mysore's 12×12 magic tour frontispiece p.225, 'Knight's Tour News' (more on Bergholt mss, and Murray History with commentary), Mystic rectangles p.248.

#15 Dec 1997 Book of Kells knot as king tour p.249, Knot Book review p.250, Intermediate magic square (and advert for *Figured Tours* booklet) p.252, Celtic Art p.262-3, Enumeration of knight tours on small boards p.265, 'H. J. R. Murray's History of Magic Knight's Tours' 266-7, Mystic rectangles 3×4 p.270.

#16 May 1999: Frontispiece an 18×18 quaternary tour (with central area using a repeating pattern) p.273. 'Fillet and Field Tours' (history and tours with maximum border braid) p.275-6. 'Incantatory and Musical Knight's Tours' p277. 'Symmetry in Knight's Tours' p.282-286. '10×10 Knight's Tours with Quaternary Symmetry' p.286-288. '14×14 Knight's Tours with Quaternary Symmetry' p.289. 'Longer Leaper Tours with Quaternary Symmetry' p.290-291. 'History of Magic Tours' conclusion p.291. 'Knightly Triangles' problem p.296.

#17 Oct 1999 'Non-Intersecting Paths by Leapers' including knight (with Robin Merson) p.297, 305-310, 316. 'Knightly Triangles' (proof that a size k triangle has area $k^2/120$) p.315. 'Knightly Quadrangles' problem p.317.

#18 Mar 2001: p.321, 327-341. 'Three Memoirs on Knight's Tours by Ernest Bergholt' reproduces the *Memoirs* 7, 8, 9 on knight's tours written in 1918, on mixed quaternary symmetry, includes three tours missed by Bergholt.

Games and Puzzles Journal [online] #19 Jan-Apr 2001: 'Four Notes on Alternating Tours' (inc D. E. Knuth), #20 May-Aug 2001 'Trapezoidal Tours', #21 Sep-Dec 2001 'Five Notes on Celtic Tours' (inc D. E. Knuth), #23 May-Aug 2002 'An Equidirectional Knight's Tour', #25 Jan-Feb 2003 'Existence Theorems on Magic Tours' includes proof magic knight's tour is impossible on a board with singly-even sides. #26 Mar-Apr 2003 'Emperor Magic Tours' about two-knight or four-knight tours where the links are rook moves. 'Quasi-Magic Tours' about tours in which the ranks are magic but the files add to two different values. #42 Nov-Dec 2005 'On the Relation of Magic Squares to Latin Squares'.

Jeepyjay Diary online (2011) 'A Magic Tour on a 12×14 Board'.two, to show it is possible on some boards $4m \times (4n + 2)$. Figured Tours (26 Nov 2015) with metasquares, (9 Dec 2016) with Legendre numbers, and (2017) the Dawson problem on the 6×6 board.

Journal of Recreational Mathematics (*JRM*): 1994 vol.26 (#3 Problems and Conjectures 2169, p.220, solution vol.27 #3 p.235-238) on 'Maximum Angles in Knight's Tours'. *JRM* 1995 vol.27 (#1 P&C 2216 p.62, solution vol.28 #1 p.77-78) on 'Crossovers in Magic Rectangles': shows a magic tour without crossover is impossible. (#2 P&C 2232 p.142, solution vol.28 #2 p.149-151) on 'Planar and Non-Planar Knight-Move Networks'. (#3 p.191-200) 'Generalised Knights and Hamiltonian Tours', including zebra tours 5×16 board and antelope tour 7×22. (#3 P&C 2258 p.219, solution vol.28 #3 p.234) on 'Circular or Bennettian Tours':The four possible closed symmetric solutions to the problem by E. W. Bennett (1947) of a knight circling about the centre always in the same direction. *JRM* 1996/7 vol.28 (#1 P&C 2304 p.63-64) on 'Piece-Wise Symmetric Tours'. *JRM* 1999/2000 vol.30 (#2 P&C 2332 p.153-154) my solution to Complete the Circuit by Sidney Kravitz, a 10×15 rook-around-the-rocks problem. *JRM* 2002/3 vol.31 (#4 P&C 2619 p.298-299, solutions vol.32, #4, p.341-343) on 'Tridirectional Knight Tours'.

Knight's Tours and Other Chessic Paths: A Chronological Bibliography. (32-pages) 1990, distributed to a few correspondents (the basis of this work).

Mathematical Spectrum (1992/3 vol.25 #1 p.16-20) 'Figured Tours'.

New Year Cards: 1984/5 a closed tour by simple-linking the C pseudotour; 1985/6 'Translational symmetry'; 1986/7 'The Sheherazade Tour' (7×11×13 = 1001-cell 3D tour); 1991/2 'Split and Fix' (16×16 tours); 2000/2001 'Three new magic tours 12×12s' (from 25).

Problemist: 1974 Bison verse p.452; vol.10 #22 Nov 1979 'Rook around the Rocks, A New Construction Task'; vol.12 #1 Jan 1985 C tour (sent on New Year card) p.3 and 16; vol.12, #9 May 1986 'Salute to Halley's Comet' upon it being visited by the Giotto probe p.159; vol.12 #10 Jul 1986 'A Unique Tour' (biaxial diamagic emperor tour) p.196.

Variant Chess: 'Knight's Tour News' #6 Spring 1991, #7 Summer 1991 (about the existence of further Murray manuscripts); #43 Nov 2003 'Recent Advances in Magic Knight's Tours' p.40-41. Summarises the results by Kumar, Roberts, Marlow, Stertenbrink. Meyrignac and Mackay. #63 Jan 2010 'On Mixed Quaternary Symmetry in Knight's Tours' p.165-169.

Websites. In 1999 I took up a course offered by the Stayfree company on creating web pages. This led to creating several websites on the free dial-up services then available. These included one for myself [http://homepages.stayfree.co.uk/gpj] one for the *Knight's Tour Notes* [http://www.ktn.freeuk.com] one for *G&P Journal* [http://gpj.connectfree.co.uk/index.htm] and a further one for the British Chess Variants Society [http://www.bcvs.ukf.net] and *Variant Chess* magazine. These sites subsequently vanished into the ether: KTN on 19 Feb 2011 and G&P Journal and BCVS around 8 May 2013. All were then reconstructed as sections of my present website [http://www.mayhematics.com]. The web pages contain far more material than can be reproduced in print, but sections from the web pages are the basis of many these Notes.

Jolivald, (Abbé) Philippe (b.1843) also known as 'Paul de Hijo'

Le Problème du Cavalier des échecs d'après les méthodes qui donnent la symétrie par rapport au centre, ouvrage contenant plus de quatre cent treize mille parcours du cavalier. Metz, Chez l'Auteur, 9 Rue Marchant 1882. [K4094] This includes a comprehensive study of pseudotours with quaternary symmetry on the 8×8 board. Pages 23-51, 63-85, 87-97, 99-110, 129-135, 140-153, 158-159, 165-167 are almost entirely taken up tedious by lists of moves, but in between are to be found some interesting results. Chapter II 'Les méthodes de Vandermonde' p.124–155, enumerates all possible ways of covering the 8×8 chessboard with four 16-move paths in quaternary symmetry. On page 154 de Hijo gives the total of 16-move closed paths in direct symmetry as 301, a figure quoted by later authorities, such as Edouard Lucas, *Recreations Mathématiques* (1895). The correct figure was shown to be 368 by T. W. Marlow (1985). An examination of de Hijo's list however shows that he did not in fact miss out any but made an error in stating the total. On page 126 the special case of four circuits in oblique quaternary symmetry with no move cutting another (the solution to 'Aladdin's conundrum') is mentioned but not diagrammed. And on the next page 127 there is a diversion in which his methods are adapted to the 6×6 board and the five quatersymmetric solutions are listed, though only one is actually diagrammed; the other tours are in coded numerical form.

Many authors have subsequently rediscovered this attractive result independently (including Bergholt 1918, Papa 1921, Cozens 1940). On pages 128 and 139 are diagrams of the 14 patterns formed at the four central squares in the cases of oblique and direct quaternary symmetry, identified by letters and descriptive names.

Le Siècle 12 May 1882 ¶1726 (12f), 19 May 1882 ¶1732 (12d), 26 May 1882 ¶1738 (12g), 2 Jun 1882 ¶1744 (12h). Four new magic knght tours, related to his work on enumerating circuits. All symmetric with 8 extended quartes. The tour (12g) when suitably oriented includes a striking letter N or Z outlined.

Jordan, Camille (1838-1922) *Rendiconti del circolo matematico del Palermo* (1888 vol.2 #1 Mar p.59-68) 'Sur la marche du cavalier'. Begins by considering the minimum number of moves (0,0) to (m,n) on an unbounded board. [Preview in SpringerLink]

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Käfer, Victor (b.1799, described on title page as: Lieutenant in der k. k. osterreichischen Armee. He was also a poet.) *Vollständige Anweisung zum Schachspiele* {Complete Instruction in Chessplay} 'Vom Rosselsprunge' (Graz 1842, vol.4 p.191-193) [M] [C] [Google Books has the text only. Some kind person published a copy of the figures on Twitter.] This article has a large plate showing 40 diagrams, comprising 16 numbered figures (one of which is a tour) and 24 other complete tours, all in geometric form, that Murray praises as "symmetric designs of great merit". Käfer is the first tour composer since Euler to place emphasis on showing symmetry in his tours. Many of the open tours show close approximations to axial, biaxial or birotary symmetry, though only two closed tours have exact symmetry. See the Exact Symmetry pages for diagrams.

Kavyalankara. See Rudrata.

Kempelen, Farkas (1734-1804) also known as Wolfgang von/de Kempelen. Creator, 1769, of the chess-playing automaton known as 'The Turk'.

Kenny, **S.** *Schachgrammatik* translated by Baumgartner, Leipzig [cited by Müllner 1825]

Kesson, H. J. alias 'Ursus' (c.1844 -) *The Queen* The Lady's Newspaper (London Aug-Oct 1881) 'Caissan Magic Squares' [Bidev 1986] [Styan 2011] This gives an 8×8 magic square using the numbers 1 to 64 in which the numbers in all rook, bishop, knight and camel lines (taken over the edges as if the board is a torus) add to the magic constant. This can be regarded as a tour by a piece with four types of move, {0,1}{0,4}{1,4}{4,4).

King's Library (c.1275) ms described by Murray, as written in Anglo-Norman, and dated as of "the last quarter of the thirteenth century" held in The King's Library (British Museum) [BM shelf mark 13A xviii, Linde 1881, Murray 1913, p.581, 589]. One of the Bonus Socius group of chess problem collections. This contains the only mediaeval European tour on the whole chessboard with the title 'Guy de Chivaler'. It is formed of two half-board tours with a single link between them. This ms uses a,b,c,d,e,f,g,h as coordinates for the files and i,k,l,m,n,o,p,q for the ranks (from top to bottom). A half-board tour occurs in the same ms, presented in the form of the 32 chessmen occupying the left half of a board. The knight in the corner is to take the white pawns first then the black pawns, "travelling twice round the board", then the bishops, knights, rooks, queens and kings in that order. See the History pages for diagrams.

Kniest, Albert Heinrich (1908 May 15 - 1984 Nov 8) *Problemist Fairy Chess Supplement* (vol.2 #1 Aug 1933 p.4) ¶909 A Dawsonian figured tour, with 'comb' design.

Knight, Charles *English Cyclopaedia, Arts and Sciences* (London vol.2 1859). Cites Roget and gives a tour from Tomlinson 1845. [Online]

Knight's Tours and Other Chessic Paths: A Chronological Bibliography. G. P. Jelliss 1990. A 32-page provisional study sent to a few correspondents in 1990, basis of this Bibliography.

Knuth, (Prof.) Donald Ervin (1938 Jan 10)

Letter to G. P. Jelliss (5 Jan 1993) citing number of symmetric closed 8×8 tours as 608,233 and the number of 8×8 closed symmetric Celtic tours as 2321.These are tours in which no triangles of minimum size occur (such as formed by the moves a1-c2, b2-d1, b1-c3).

Games and Puzzles Journal [online] #19 Jan-Apr 2001 in 'Four Notes on Alternating Tours'; #21 Sep-Dec 2001 in 'Five Notes on Celtic Tours'.

Journal of Recreational Mathematics (vol.2 #3 Jul 1969 p.154-7) Letter on non-crossing knight paths. See Yarbrough for some diagrams.

Mathematical Gazette 'Leaper Tours' Nov 1994 p.274. [MG Index online]

Selected Papers on Fun and Games 2010 §40-43 relate to tours.

Koninklijke Bibliotheek 'Bibliotheca Van der Linde - Niemeijeriana' A Catalogue of the Chess Collection in the Royal Library, The Hague 1955. Section on Mathematics (p.168-171) has 61 entries numbered K4063 to K4123. This includes other subjects besides knight tours.

Korn, W. *Encyclopedia Britannica*, 15th edition. 'Chess'. Cites Bidev 1964.

Kotesovec, Vaclav: *Games and Puzzles Journal* #20 (online) May-Aug 2001 'Longest Shortest Leaper Paths'; *Dual-free Leaper and Hopper Tours*, Prague 2009. Czech but notes in English.

Kowalewski, Gerhard Waldemar Hermann (1876 Mar 27 - 1950 Feb 21) *Alte und Neue mathematische Spiele* 1930. Rösselsprungproblem p.64.

Kraitchik, Maurice (1882 Apr 21 Minsk - 1957 Aug 19 Brussels):

L'Echiquier 'Le Problème du Cavalier' a series of articles. The author was not stated until the work was republished in extended form in 1927. **#15 Mar** 1925 p.57–59. §1 Statement of the problem. §2 History. Diagrams of the de Montmort (dated 1708) and Moivre (1722) tours. §3 On number of solutions. §4 Open and closed tours. §5 Symmetry. §6 Euler's cross-shaped tours. §7 Symmetry with respect to a median. Examples 8×8 approximately symmetric, 8×8–2, 5×6, 9×10. §8 Quaternary symmetry. Examples 6×6, 7×7–1, 8×8–4. **#16 Apr** p.78-80, Ch.2 Méthodes générales. §9-12 Euler's method. §13 Warnsdorf. **#17 May** p.98-100, §14-16 Tourability of shaped boards. **#18 Jun** p.123-4, Ch.3 Methods applicable to 8×8. §17 Vandermonde. §18 Collini. §19 Squares and Diamonds and Roget. **#19 Jul** p.147-8, Ch.4 Quelques parcours remarquables. §20 Compartmental tours. §21 Two half-boards. **#20 Aug** p.166-8, §22 Graphical examples. §23 Half of tour covering a regular pattern of cells. Ch.5 Conditions graphiques. §24 Graphical representation. §25 Tours with two-move lines. §26 Tours with 3-move lines. §27 Tours with maximum moves in given directions. §28 Equipartition of directions. §29 Tours showing crosses, letters etc. §30 Four stars in corners. **#21 Sep** (?) Ch.6 Conditions numériques. §31 Relation of numbering and symmetry. §32-34 Magic conditions. §35 On board of side 4k+2. Semimagic 6×6 example. §36 On board of side 4k. Two 8×8 examples. §37 Jaenisch. **#22 Oct** p.212-5, Ch.7 Boards 4×N. §38-50. Extensive enumerations based on Sainte-Marie (1877) results. **#23 Nov** p.237-240, Ch.8 Généralisations. §51-53 Some general rules. §54 Boards 3×N. §55-57 Board 5×5. **#24 Dec** p.261-3. §58 Board 6×6, gives the 17 singly symmetric cases. §59 Symmetric open and compartmental tours 7×7. §60-62 Larger boards. [My own copy, since sold.]

Le Problème du Cavalier 1927 (cover has: Bruxelles, Edité par l'Echiquier, but title page says: Paris, Gauthier-Villars et Cie). Much of this book is reproduced from *l'Echiquier* 1926 but in smaller format. The book adds a preface, three further chapters and some extra paragraphs. There are now 81 sections. Ch.9 Généralisation de la marche du Cavalier. §63 Definition of sauteur (a, b). §64 Tours by (3, 1), seven examples. §65 Numerical property of (3, 1) tours; all cells in same row are of same parity. §66 Two open tours and one closed on 10×10 by (3, 2). §67 Open tour 9×9 and closed quatersymmetric tour 10×10 by (4, 1). §68 Fixed distance leapers can have two types of move, example (7, 4) and (8, 1). §69 Closed 8×8 tour by (3, 4) + (5, 0). §70 Closed tour by (7,1) + (5,5) on white cells of 12×12. Ch.10 Parcours doublement symétriques. §71 Definition = oblique quaternary symmetry. §72 Every such tour covers 4N cells, is closed, and cells corresponding by quarter-turn have constant difference of N. §73 Odd order squares. Tours on 7×7 minus centre, 23 diagrams. Examples of side 9, 11, 13, 15. §74 Side 4k+2. Examples 10, 14. §75 Side 4k. Examples 8, 12, 16 minus four centre cells. Ch.11. Board 3×N. §76–81. Enumerations up to 3×14. [My own copy]

La Mathématique des Jeux 1930 Brussels, p360, 402, on number of tours.

Le Sphinx Editor 1931. A magazine for mathematical recreations [see preface to Kraitchik 1953] contains work 1932-3 by E. Lange (tours with lines in given directions) and magic tour by M. B. Lehmann 1933.

Comtes Rendus du Premier Congres International de Recreations Mathematiques (*CIRM*) Brussells 1935 Editor. Includes essays by T. R. Dawson on figured tours and by E. Huber-Stockar on tours using several different leaps in given directions.

Mathematical Recreations (W. W. Norton Co, first edition 1943, Dover Publications 2nd edition revised 1951). Chapter 11 The Problem of the Knight, p257-266. Summarises results given in his 1927 work, with a few corrections.

Kumar, Awani (1962 Aug 10) biographical details and photo in *Indian Chess History* p.208.

Games and Puzzles Journal (online) #22 Jan-Apr 2002 'Semi-Magic Knight Tours on the 6×6 Board' (Reports a complete enumeration of these tours, finding 88 in all. Fuller details on KTN website); #24 Sep-Dec 2002.'Near-Perfect Magic Knight Tours on the 12×12 Board'; 'The Raja of Mysore's Tour and Related Tours'; 'Some New Almost Perfect Magic Tours'; 'Two Tours Nearest to Perfection'; 'A Tour by Murray and Related Tours'; #26 Mar-Apr 2003 'In Search of 12×12 Magic Square Tours'; 'Four Perfext Magic Tours 12×12' (diagonally magic; still the only 12×12 examples known); 'A New Type of Magic Tour' (diagonals are equal but different from the magic constant); #32 Mar-Apr 2004 'Studies in Magic Tour of Knight on 12×12 Board' #42 Nov-Dec 2005 'Further Studies in Magic Tour of Knight on 12×12 Board' About tours with one diagonal and broken diagonals magic.; #43 Jan-Apr 2006 'Studies in Tours of the Knight in Three Dimensions'.

2008 Mar: 'Non-crossing Knight's Tour in 3-dimension'. arXiv:0803.4259 [math.CO]

2008: *Mathematical Gazette* v.92 #523 p.111-114 'Magic knight's tours ... in 3 dimensions'.

2008: Unpublished? 3343 semi-magic 10×10 open tours and one on 30×30 board.

2009 *Mathematical Spectrum* v.42 #1 p.20-25 'Construction of Magic Knight's Towers'.

2012 Jan: 'Magic Tours in Higher Dimensions' arXiv:1201.0458 [math.CO]

2017 Aug: 'Magic Tours of Knight in 4x4x4 Cube' arXiv:1708.06237 [math.GM]

2018 Feb: 'Studies in Tours of Knight on 4 by n Boards' arXiv:1892.09340v1 [math.GM]

2018 Dec: 'Studies in Tours ... on Rectangular Boards' arXiv:1892.09340v2 [math.GM]

Kuratowski, Kazimierz (1896 Feb 2 - 1980 Jun 18) *Fund. Math.* 1930 v.15 'Sur le probleme des courbes gauches en topologie' p.271–283. (cited as by C. Kuratowski in Bondy and Murty 1977). The remarkable theorem providing a test for the planarity of a network by absence of pentagrams and triglyphs. See Theory of Moves (p.10).

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Laing, Lloyd and **Laing, Jennifer**: *Art of the Celts* 1992. See the note on Knots.

Laisement, Denis Ballière de (1729-1800) known as a music analyst. *Essai sur les Problèmes de Situation...* (Rouen, chez Jean Racine, 1782, 74 pages) [C] [K4068] [Google Books - but the plates are not folded out] This has been an unjustly neglected work. It has seven plates (labelled A and I to VI) and includes tours on larger boards 10×10, 12×12 and 16×16 as well as 8×8 tours showing approximate symmetry and graphic features (e.g. stars in the four corners). [Scans of the plates purchased from The Koninklijke Bibliotheek.]

Lalande, Joseph-Jerome Lefrancais de (1732-1807) See *Dizionario Enciclopedico delle Matematice* (1800)

Lamarle, Anatole Henri Ernest (1806 Sep 16 Calais - 1875 Mar 14 Douai) *Mémoires de l'Academie Royale Belgique* (vol.27 1852) 'Solution d'un coup singulier' [M]

Lamouroux, (Monsieur) — *Nouvelle Regence* 1860. 'Probleme de deux Cavaliers parcourant les 64 cases de l'echiquier en 32 coup chacun'. A pseudotour with horizontal axis. (See p.425.)

Lancel, Edmond Emile: (1888 Jul 3 - 1959 Apr 15) [biographic details from www.chessgames.com] editor of *L'Echiquier*, chess magazine, Bruxelles, published 1925-1939: #2 Feb 1925 p.44. Magic knight's tour attributed to Mansion, actually by Wenzelides. #4 Apr 1925 p.83-4, solution #7 Jul 1925 p.151. Euler's 10×10 tour. Rook tour. L-shaped cryptotour of three 5×5s, one letter per square. See also Errera 1925, Kraitchik 1926, Vatriquant 1928-9.

Lange, E. (of Hamburg): *Sphinx* 1931 (tours with lines in given directions). Large magic tours by adding borders to 8×8 tours in M. B. Lehmann*'s Neue Mathematische Spiele*: *Der Geometrische Aufbau Gleichsummiger Zahlenfiguren* 1932. See also S. Vatriquant 'Les parcours magiques de Lange' in *Sphinx* 1932-33 [K]

Lange, Max (1832-1899) *Lehrbuch des Schachspiels* 1856 'Die Lehre vom Rosselsprung' (p.193-199), 'Systematische Theorie des Rosselsprungs' (p.199-202). Has Guarini half-board tour, and Wenzelides (12a) magic tour. [L][online] Also editor of *Thon's Meister im Schachspiel* ... 1863. 'De Leer van den Paardensprung' *Sissa* (1871 p.7-13, 35-37) is after Max Lange (1856).

Langstaff, W. in *Fairy Chess Review* ¶5589 1943 antelope 50-move open path, ¶5732 Oct 1943 p.61 and Dec 1943 p.70, a 52-move solution, later surpassed.

Lapierre, A. (of Wattrelos) *Fairy Chess Review* (vol.3 #16 Feb 1939 p.175) ¶3591-2 monogram tours showing FCR and TRD. (vol.3 #18 Jun 1939 p.199) ¶3762 monogram AL.

Laquière, Emmanuel M. *Bulletin de la Société Mathématique de France* (Paris vol8 1880 p.82-102, 132-158) 'Géometrie de l'Echiquier, Solutions Regulières du Problème d'Euler sur la Marche du Cavalier'. Roget's method restricted to closed tours of the nets; such tours are 16-move paths of H or C shape. Recognises the role of the linkage polygon formed by the alternate deleted and inserted moves. Applies squares and diamonds to the 4×8 board [A][C][K 4093.] (Paris vol.9 1881 p.11-17) 'Note sur le Nombre des Marches Rentrentes du Cavalier'. Extends the figures of Sainte-Marie (1877) to find the number of 8×8 reentrant tours formed of two 4×8 tours. Gives total 31,054,144, which is the number of tours presented in numerical form, i.e. 16 times the generic number which is 1,940,884. [A]

Lasa, (Baron) Tassilo von Heydebrand und von der (1808? 1818 Oct 17 - 1899 Jul 27):

Zur Geschichte und Literatur des Schachspiels {On the History and Literature of Chess} subtitle *Forschungen* {Researches} (1846 p.164, and 1897). This subtitle is sometimes used as a shorthand for the work. "Considered a Florentine tour 4×8 (end of 15th century), combined with a copy of itself on an 8×8 board, to be the oldest instance of a reentrant tour in existence. He was not aware of the earlier Arabic instances." [Murray 1902]

Schachzeitung (Berlin, vol.1 1846 p.188–191) 'Lösung des Rösselsprung'; (vol.2 1847 p.79–86, 97–103) Collini, method of quartes etc. [Lucas 1895][A]. (vol.17 1862 p.65-69) Review of Jaenisch Treatise. [A] Also in *Bull. de la classe physico-mathém. de l'Acad. Impér. des sc. de St-Petersbourg* (vol.6 1863 p.473-7). [A]

Editor of *Bilguer`s Handbuch des Schachspiels* [see Bilguer];

Lauber, G. *Aufklärung von Schachgeheimnissen* ... (F. Schmeer & Sohne, Ratibor 1877). Has 20 cryptotours. 12 on the 160-cell four-handed chess board. [C] [K 4092] [Google Books, but the line drawings are not folded out]

Lavernède, J. E. Thomas de: 'Problème de Situation' in *Mémoires (1838–39) de l'Académie Royale du Gard de Nimes* (Nimes 1840, p.151–179) [C]. Thomas may be his surname, but he is usually cited as Lavernède. Listed tours of squares and diamonds type. In the final part from §18 on there is also some discussion of other tours. The tour in Table 10 referred to as 'marche M' is the one by Mairan (1725), not Moivre as stated on p.171. See Squares and Diamonds History section.

Leathem, George: in *Fairy Chess Review* 1939.

Legendre, Adrien Marie sometimes spelt Le Gendre (1752-1833): *Théorie des Nombres* (Paris 1830, 3rd edition, vol.2, p.151-165) [cited by de Lavernède (1839) and Ball (1939)] [L] [C] [online] Gives an account of Euler's method. A number of arithmetical arrays are given including five irregular reentrant tours.

Lehmann, Max Bruno (1898 Jul 8 -): *Neue Mathematische Spiele* (series title): *Der Geometrische Aufbau Gleichsummiger Zahlenfiguren* 1932. Catalogues all 87 magic knight tours known at the time. Also larger magic tours 12×12, 16×16, 24×24 by E. Lange, and magic king tours p.360-362; *Le Sphinx* Aug 1933 Magic tour 16a No.88. See Magic Knight Tours for diagram.

Leipziger Illustrirte Zeitung #111 (16 Aug 1845). Has a cryptotour, possibly the first German example. [Elke Rehder website] The solution is a corner-to-corner tour in two halves, almost completely (14/16) of squares and diamonds. The same source contains a tour with a distinctive diagonal pattern.

Leonhardt, N. F. *Handbuch fur angehende Schachspieler ...* (Altona 1857 p.149–155) [C]

Lester, William Edward (1895 Feb 1 - 1940 Dec 3) *Problemist Fairy Chess Supplement* (vol.1 #11 Apr 1932 p.68. sol #12 Jun 1932 p.75) ¶404 circuits by root-85 leaper. *Fairy Chess Review* (vol.3 #8 Oct 1937 p.86, #9 Dec 1937 p.99. #10 Feb 1938 p.110) ¶2930-31 ¶3035-36 non-crossing Emperor figured tours. *British Chess Magazine* (1946 vol 66 p.136, 204, sols p.202, p.269) ¶7037 and ¶7108: Knight + Queen tours on the 9-cell shaped board a123, b234, c345. (a) 19 of two knight and six queen moves..(b) 9 Non-intersecting routes of two knight and five queen moves.

Lewis, (Rev) Angelo John: see Hoffmann 1893.

Libri, G. *Comptes Rendus de L'Academie Des Sciences* 1842 'Mémoire sur l'emploi des fonctions discontinues dans l'analyse, pour la recherche des formules générales' p.401-411. Mentions the knight's tour work of Moivre, Euler and Vandermonde p.408 and recent work by Lavernède and Ciccolini in a footnote, but no actual tours.

Liddell & Scott, *Greek-English Lexicon, abridged* (1935, p.148, 786). See note on Labyrinths.

Ligondès, (Vicomte) Raoul de (1847-1917) pen name 'Palamède'. There were a number of Counts Ligondès and I'm not entirely sure I've found the right one! My catalogue of magic knight tours lists 36 as composed by Ligondès, exactly one third of the 108 total.

Polygraphie du Cavalier, Orleans, 1874 [M] This date may be a misprint for 1884. *Polygraphie du Cavalier Appliquée a la Recherche des Carrés Magiques* 1884, 1906, 1910, 1911 [M] These are a series of privately printed works by Ligondès that Murray describes, containing his results on magic knight's tours, but I have never managed to locate any of these. His work appeared mainly in French newspaper chess and puzzle columns.

Le Siècle (Un Probléme Par Jour column of A. Feisthamel) which can now be consulted online. The following is a list of the problem numbers and dates of those that appeared in *Le Siècle* in 1883/4. The first is ¶1996 23/30 Mar 1883 a tour (05g) with a striking crossover in the middle. The series continues: ¶2086 6/13 July 1883 and ¶2092 13/20 July 1883, two sets of three tours consisting of one of (27) type and five of (34) type but only three of these (34b 34c 34d) are new [the other three (27i), (34a), (34e) were previously found by Exner (1876)] Next ¶2098 20 July 1883 a set of nine magic tours (14ab, 23 eghijkl). They are presented as a cryptotour having a 3×3 array of letters in each cell of the chessboard. ¶2110 3/10 Aug 1883 (23d, 25a) [and (05d) which is attributed by Murray to Bouvier 1882] ¶2116 10/17 Aug 1883 (23fmn). ¶2122 17/24 Aug 1883 (03f, 01b, 00g). ¶2128 24/31 Aug 1883 (14c, 01c, 23c) [but (23c) also appears earlier in *Le Gaulois*]. ¶2242 4/11 Jan 1884 (34f) [this is given as part 1 of a problem which has the Feisthamel tour (14d) as part 2]. ¶2248 11/18 Jan 1884 (34g). ¶2254 18/25 Jan 1884 (03e). ¶2260 25 Jan / 1 Feb 1884 (03a). ¶2266 1/8 Feb 1884 (01a, 03cd).

Le Gaulois ¶584 9/16 Jul 1883 (34e) is anticipated by Exner 1876, ¶608 6 Aug 1883 (23c).

La Mode du Petit Journal a fashion magazine (1906, 1910 and 1911) Count Ligondès published a new cyclic magic tour (00h) and two new magic open tours (23o) and (23p). These are 85-87 in the historical sequence. These were his last contributions to the subject. **(00f) (23b)?** See Magic Square Knight Tours for diagrams.

Linde, (Dr) Antonius van der (1833 Nov 14 - 1897 Aug 12) *Schachlitteratur, Bibliographische* Dec 1870 [cited by Meyer 1873] *Geschichte und Litteratur des Schachspiels* 1874 vol.1 p.245 (diagrams 243-246), p.292-5 (history), vol.2 p.101-111 (bibliography). Reprint by Olms, Zurich, 1981. [British Library 2738.cc.1 or 7913.ff.23] [Singmaster] *Quellenstudien zur Geschichte des Schachspiels* {Source-studies for History of Chess} (1881 p.196-198). Includes tours from mediaeval manuscripts. §18 is the Florentine 4×8 tour, §19 the Civis Bononiae and Guarini 4×8 tours, §20 the King's Library 8×8 tour and §21 the King's Library and Nikolai 4×8 tour problems. [details from K. Whyld]

Lionnais, Francois, le. See *Dictionnaire des Echecs* 1967.

Litmanowicz, W. Ladyslaw See *Szachy od A do Z* 1987.

Löbbing, Martin and **Wegener, Ingo**: The Number of Knight's Tours (1996). A claim to have enumerated the tours on the 8×8 board, by computer methods, but their figure is definitely wrong, not being divisible by 4. (See McKay 1997) 'Comments on Martin Löbbing and Ingo Wegener, The Number of Knight's Tours ...' by the authors and by B. D. McKay.

Loubère, S. de la: *Du Royaume de Siam* (English Translation, London 1693, vol.2, p.227-247). [cited by Rouse Ball 1939] Describes a version of the step-sidestep method for magic squares whch he learnt while French envoy to Thailand in 1687-88. The rule is to place 1 in the middle of the top row, to step diagonally upwards to the right one cell (regarding the board as a torus) and to sidestep one cell down when blocked. See also Moschopoulos (~1315).

Locock, C. D. (with T. R. Dawson); *Pittsburgh Gazette-Times* 1917. A tour puzzle.

Loyd, Sam(uel) (1841 Jan 30 Philadelphia -1911 Apr 10 Elizabeth NJ): *Le Sphinx*, Mar 1867 'The Queen's Tour' (14-move problem) and in Cook et al *American Chess Nuts* 1868; *Chess Strategy*, 1878 p.175 and 1881 p.337. Rook tour problem. The problem of a 16-move non-intersecting rook closed tour of the standard chessboard was proposed and solved with one example (the 'four-pronged' pattern); in *Tit Bits* 1897. See also A. C. White 1913.

Lucas, François Edouard Anatole, aka 'Monsieur Claus' (1842 - 1891 Oct 3): the *Récréations Mathématiques* (v.3 p.v-vii prelims) has a moving obituary notice about his premature death: "Edouard Lucas succombait, dans toute la force de son talent, aux atteintes d'une courte et terrible maladie. Cette morte prématurée — il n'était àgé que de quarante-neuf ans — laissait un grand vide dans la Science, en meme temps qu'elle frappait de stupeur ses nombreux amis."

Revue Scientifique 22 Sep 1882 'Le Saut du Cavalier au Jeu des Echecs' p.370–375. (a) Number of undirected knight moves on p×q board is (2p–3)(2q–3) – 1, i.e. 168 on 8×8 board. (b) The four-knights problem on 3×3 attributed to Guarini (now known to date back to al-Adli). (c) The three tours of a 3×4 board given by Euler. (d) Euler's two cross-shaped tours with diagonal axes of symmetry. (e) The Montmort, Moivre and Mairan tours of 1722 are mentioned but not diagrammed. (f) Mentions that according to the *Encyclopédie* of d'Alembert and Diderot the problem was known long ago ('tres anciennement') in India. (g) The Guarini 4×8 tour. (h) Symmetric tour by Euler formed by joining two 4×8 tours. (He seems to imply that this half-board tour is identical to the one by Gianutio, but though similar they are not in fact identical.) He claims the number of tours of this type is 3872. (i) Quotes a 64-word cryptotour poem (from *Le Palamède* 1842, series 2, v.1, p.322). (j) Notes on Vandermonde, Ballière de Laisement, Simonot, Crétaine, Solvyns, de Hijo, and symmetry. (k) More general but inconclusive notes on mathematical topics including Hamiltonian tours on networks. There is a footnote on p.374 citing a domino problem in the 1883 vol.2 of *Récréations Mathématiques* by Lucas, but presumably he would have had prior knowledge of this; or else the copy I have seen (from Cleveland Library) is a later reprint with added notes. This entire article is reproduced in different format as Note I, p.205–223 in v.4 of *Récréations Mathématiques* published posthumously in 1894.

Récréations Mathématiques, Gauthier-Villars et Fils, Paris (4 vols, 1882, 1883, 1893, 1894). Vols 3 and 4 were edited by H. Delannoy, C. A. Laisant and E. Lemoine from papers left by Lucas at his death in 1891. Vol.3 prelims p.v-vii, has a moving obituary notice about his premature death. "Edouard Lucas succombait, dans toute la force de son talent, aux atteintes d'une courte et terrible maladie. Cette morte prématurée — il n'était àgé que de quarante-neuf ans — laissait un grand vide dans la Science, en meme temps qu'elle frappait de stupeur ses nombreux amis." Vol.4 Part 6: 'Le Géometrie des Réseaux et le Problème des Dominos' includes p.130-131 an extension of his results on the number of knight's moves on a p×q board to the case of generalised moves. The Note I p.205–223 reproduces his 1882 article on the knights leap. [Leicester University Library]

Nouveaux Jeux Scientifiques... 1889, La Fasioulette, p.302 and Fig. p.301. This is an 8×8 board with 64 links of length root 5 to form knight's tours. [Singmaster]

Théorie des Nombres 1891 (not clear if this has anything on tours).

L'Arithmétique Amusante, Gauthier-Villars et Fils, Paris 1895. Edited by H. Delannoy, C. A. Laisant and E. Lemoine from papers left by Lucas at his death in 1891. Note 4 Part 6 Le Saut du Cavalier covers: Collini, Squares and diamonds (attributed to Ciccolini), Jaenisch, Vandermonde and de Hijo, Warnsdorf, Sainte-Marie, Laquière, symmetries, and border method for extending tours to larger boards. Based in part on Lucas 1889 and Frolow 1886. [Leicester U. Library]

Luke, Dorman: *Recreational Mathematics Magazine* 1962 Tours on a toral board.

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Mackay, Hugues with **Meyrignac, Jean-Charles** and **Stertenbrink, Günther**. *Computing Magic Knight Tours* [http://magictour.free.fr/] 2003. Added five new 8×8 magic tours, completing the catalogue and showing that a diagonal magic tour is impossible.

Maczuski, A. L.:*Boy's Own Paper* 1883. Tour showing letter 'B'. *La Stratégie* (15 Jun 1895 p.177). This gives an account of a chess display put on by Maczuski on 11 Jun 1895 at Café Diollot in Amiens. Maczuski played a group of amateurs sans voir at the Evans Gambit Accepted. Then his pupil Mademoiselle Stella Goulieux demonstrated from memory the eight queens placement problem, and showed a series of knight's tours spelling out the letters of AMIENS and the initials FF of the President, Felix Faure. David Pritchard sent me a further reference to *La Strategie* v.32 (1899) p.114, referring to an 'M' tour. [Meyrignac, Pritchard]

Madachy, Joseph Steven (1927 Mar 16 - 2014, Mar 27): *Mathematics on Vacation* (1966 p.88) a 16×16 diagonally magic closed knight tour (by Willcocks or de Vasa). Founder/editor of *Recreational Mathematics Magazine* and the *Journal of Recreational Mathematics*. See also *Mathematical Diversions* (1963).

Maelzel, Johann Nepomuk, (1772 Aug 15 - 1838 Jul 21). Owned Kempelen's automaton from 1804.

Maget, Ernst; See *Dictionnaire des Echecs* 1967.

Mairan, Jean-Jacques d'Ortous de (1678-1771) tour in Ozanam 1725. According to a marginal note, this tour and those by Moivre and Montmort were supplied to the editor of that edition in 1722 by Mairan, who was Director of the Académie Royale des Sciences, Paris.

Manasollasa 'Delight of the Spirit' a traditional sobriquet for chess, a 'Princely Mirror' written for King Somesvara III of the Kalyani area in central India (c.1150). See F.Bernhauer (1995).

Mani, Ali ibn: Composer of an 8×8 tour in the al-Hakim manuscript c.1350.

Mann (Jr), G. *120 neue Rösselsprunge ohne nebst einer kurzen Einleitung*, Nürnberg 1859. [C] [online] The tours in this, presented in graphic form six to a page are mostly open tours of near-axial symmetry. Tour #87 is the 1848 *Sissa* tour with diagonal pattern, so maybe the tours are not all 'new'. Tours #111 to #120 are reentrant tours of squares and diamonds type, but none are completely symmetric. The last includes 7 three-move lines. At the end he gives tours on three and four-handed chess boards.

Manning, W. ms *The Knight`s Tour*, in the von der Lasa library, no date, c.1850? [L]

Mannke, W.J. in *Journal of Recreational Mathematics* 1968.

Mansion, — 'Sur les Carrés Magiques' *Nouv. Corr. Mathém.* (vol.2 1876 p.161, 193) [A.] A magic tour in *L'Echiquier* (1925 p.44) and Kraitchik (1927 p.37) attributed to Mansion is in fact (12a) by Wenzelides.

Mantia, della: see Gianutio 1597

Marlow, Thomas William (1927 Jan 24 - 2011 Sep) obituary in *Jeepyjay Diary* 25 Mar 2017.

Chessics (#12 1981 p.7-9 and 12-13) 'Rook around the Rocks'. (#15 1983p.6-7, sols #16 1983 p.5) 'Grasshopper Gallery'. (#24 1985 p.92-3) 'Sixteen-Move Knight Paths' a check on the results of de Hijo 1882 and Fiveleaper 6×9 tour. (#29+30 1987 p.162) a 4×4×4 tour. Taking up the project suggested in *Chessics* 1986 Tom Marlow applied computer methods to enumerate all magic knight tours of regular quartes type and found five new tours. (01g, 01h, 03b, 23q, 25b). Two were published in *G&P Journal* 1987 and all five in *Problemist* 1988. The conclusion was that there are 78 such tours in total. One of the five tours found (03b) fortunately replaced the erroneous tour in my catalogue. See Magic Square Knight Tours for diagrams.

Games and Puzzles Journal vol1 #1 Sep-Oct 1987 Two new magic tours (23q and 01g) p.11; vol.2 #15 Dec 1997 all known diagonally Magic King Tours with biaxial symmetry p.264; #16 May 1999 Enumeration of closed knight tours with quaternary symmetry on 10×10 board finding total **415902** p.288, Longer leaper tours with quaternary symmetry p.290-291; #17 Oct 1999 A Double Tour (by Fiveleaper) p.319 (solution #18 Mar 2001 p.347).

Problemist vol.12 #19 Jan 1988 'Magic Knight Tours' a computer enumeration of the 78 tours of quartes type, finding five new tours (01g, 01h, 03b, 23q, 25b) p.379.

Games and Puzzles Journal online: #22 Jan-Apr 2002 'Diamagic Knight's Tours on Torus and Cylinder'; #25 Jan-Feb 2003 'A Semi-magic 10×10 Knight Tour with quaternary symmetry'.

Knight's Tour Notes [website] a page of Magic Fiveleaper Tours.

Marques, —: tours on small shaped boards, See *L'Echiquier* 1928-9.

Mason, William: *The Good Companions Chess Problem Club Folders* (1917 vol.4 #9 Mar p.207-8) [BCPS Library] Describes an elaborate mnemonic for memorising a knight's tour. 'A stunt I used to do over fifty years ago.' As described by G. Walker *Fraser's Magazine* 1840.

Massmann, H. F. *Geschichte des mittelalterlichen vorzugsweise des Schachspiels* (Quedlinburg, Leipzig 1939) [cited by Meyer 1873][title from Google Books] Has an extensive bibliography but no actual tours.

Mathematical Diversions by J. A. H. Hunter and Joseph S. Madachy: (Van Nostrand, Princeton, 1963, p.86-7) [cited in Willcocks 1962!]

Matsuda, Michio: *Journal of Recreational Mathematics* (vol.2 #3 Jul 1969 p.154-157) Letter on non-crossing knight tours. See Yarbrough for diagram of 9×9 path.

Mattey, J. R.: 'Chessboard Puzzles' series in *Chess Amateur* (1907-1910): vol.3 (x 1908 – ix 1909) ¶28, p.115, 179, rook tour in 15 moves a1-a6, posed by T. R. Dawson after J. R. Mattey.

Mauvillon, Friedrich Wilhelm von (1774-1851) a Dutch army officer who played the first known correspondence chess games with a friend in Breda while stationed at the Hague in 1804 and published them in 1827 [biographic details from www.chessgames.com]. The title is *Anweisung zur Erlernung des Schachspiels, mit besonderer Rucksieht auf diejenigen denen das spiel durchans unbekannt ist* (Essen, Baedeker, 1827). The tours are in Chapter 6 §12 Rösselsprung p.239-240 and Tab X Figs 1-5 [Google Books] [L also has p.382] A Dutch version by J. de Quack *Handleiding Tot Het Leeren Van Het Schaakspel: Naar Het Hoogduitcsh* (Rotterdam, Mensings and Westrenen 1828 2 vols) may not contain the tours.

McCoy, J. C. 'The Anatomy of Magic Squares' series, 16 articles 1938-1945 *Scripta Mathematica* (#8 1941 p.15-26) 'Manuel Moschopoulos treatise on magic squares' (#12 Mar 1946 p.79-86) 'The Magic Knight's Tour'. [Cited in *The Pentagon* (Kappa Mu Epsilon) vol.10, Fall 1950]

McGuffey, G. E. *Fairy Chess Review* (vol.3 #8 Oct 1937 p.86, sol Dec 1937 p.96) ¶2932 Cryptotour with one letter per cell. See Cryptotours section.

McKay, Brendan D. *Technical Report*, TR-CS-97-03 Feb 1997, Computer Science Department, Australian National University, Canberra, ACT 0200, Australia. This followed up enumeration work of M. Löbbing and I. Wegener (1996). Dr McKay reports the total number of geometrically distinct closed tours of the 8×8 board (or in his jargon "equivalence classes under rotation and reflection of the board") to be: **C = 1,658,420,855,433**. and confirms the number of symmetric closed tours (Knuth 1993) to be **B = 608,233**. To determine the exact number of open tours remains an unsolved problem.

Mercklein, (Prof.) Frédéric-Auguste-Adolphe Professeur de Sciences Appliquées a l'Ecole Imperiale d'Artillerie de Douai *Memoirs de la Société Inpériale d'Agriculture, de Science et d'Arts séant à Douai* (ser.2 vol.7, 1863/4 p.151-155) 'Marche du Cavalier du jeux des echecs parourant les 64 cases de l'echiquier'. Divides the board into 16 blocks 2×2, and aims to vistit all 16 then repeat the series. In effect this is a simplified version of Roget's method. One tour is given, a four-slant tour numbered b7-c5 over four diagrams giving the four 16-move series. This is a Rogetian and Collinian tour with the minimum number of four slants. Tour almost identical to one by Chapais (1780). See the note on Collinian tours. Mercklein is also mentioned in *Le Sphinx* (vol.6 1866 p.473-477) [L].

Merson, Robin, H. (1914 - 1992 Aug). *Games and Puzzles* magazine (#9 1973) Letter with results on non-crossing knight paths. On KTN website: Letters to G. P. Jelliss on non-crossing knight and other paths 1990-1, basis of: 'Non-Intersecting Paths by Leapers' *The Games and Puzzles Journal* (vol.2 #17 Oct 1999 p.297, 305-310). Still holds many length records.

Meyer, Heinrich: *English Mechanic and World of Science* Aug 1872 Letter in answer to a query. Includes diagram of Vandermonde's tour. *The Leisure Hour* v.22 1873 'The Knight's Tour'

p.813-815. (a) Five tours showing a high degree of axial symmetry; the first is Vandermonde (1771) three are by V. Gorgias (1871), the fifth is the Jaenisch (12n) magic tour. (b) Follows up J. B. D— (1873) to give a correct count of the number of 8×8 tours classified by end cells: 115 non-reentrant + 21 reentrant, total 136. (c) List of references. [K4089.] [Leicester University Library: PER 05C.L424]

Meyrignac, Jean-Charles: See Mackay. Also semi-magic tours on 4-rank boards.

Miles, John Augustus (1817 Dec 4 - 1891 Jul 23); *Poems and Problems* 1882. The last item is a cryptotour bearing the title 'The Retrospect' which uses a passage from *Ossian* (J. Macpherson) [cited by N. M. Gibbins in *FCR*] *British Chess Magazine* (vol.4 1884, p.72). A cryptotour using the Beverley magic tour. [Murray 1930]

Miller, W. J. C. See Biddle.

Minding, Ferdinand (of Dorpat): *Bulletin de l'Academie des Sciences de St Petersbourg* (vol.6 #14 22 Jan 1847). Gives some rather elaborate algebraic theory directed at the number of tours, but producing no definite results. German: *Crelle's Journal (fur Reine und Angewandte Mathematik)* (Berlin vol.44 1852 p.73-83) 'Uber den Umlauf des Springers auf dem Schachbrette (den sogenannten Rösselsprung)'. English version in *Cambridge and Dublin Math. Journal* 1852.

Mitchell, (Dr) S. Weir was one of a group of citizens of Philadelphia who bought the automaton after the death of the showman Maelzel in 1838 and exhibited it until it was destroyed by fire in 1854. To show a tour from any square it is of course sufficient to know one closed tour. A template for this purpose for use in the machine was presented by Dr Mitchell to the Chess Library of George Allen (1808-76) which was acquired by the Library Company of Philadelphia, in which collection it still apparently survives. [However, when I enquired in the 1980s, they were not able to locate it.] It is 13 inches square, creased to be folded into quarters and pierced to be hung on a hook. Inside the automaton it fitted over an array of 64 plugs on what I suppose can be called the operator's 'control board'. A photo of this artefact is in the *Good Companion Chess Problem Club Folders* (1917, p.140). It shows Euler's first closed tour.

Moivre, Abraham de (1666 - 1754); tours in Ozanam's *Recreations* 1725.

Mollweide, Carl Brandan (or Carolus Brandanus): *Dissertationis Mathematicae de Quadratis Magicis Pars Prior* (Leipzig 1816) [A][L]; 'Uber das Problem des Rösselsprungs' Klügel's *Mathemat. Wörterbuch* (Leipzig 1823, or 1843, vol.4 p.458-467 art: Springer auf dem Schachbrett) [L][M].

Monge, **Gaspard** (1746-1818). Tours in unpublished manuscripts 1780 reported by H. Bastian.

Monneron, —. Possibly Jean Louis Monneron (1742-1805) one of several brothers in a prominent French family. Writing from the East Indies to the *Nouveau Dictionaire pour servir de Supplement aux dictionnaires des sciences des arts et des metiers (tome second BO-EZ)*, edited by Charles-Joseph Pancoucke, Paris 1776. The article *Echecs* p.749 has two tours. One is attributed to a Malabarese composer and the other is the Nilakantha tour.

Montferrier, Jean-Pierre Sarrazin de: *Dictionnaire des Sciences Mathématiques* (vol.1 1778 p.489) gives Euler's first two tours. *Encyclopédie Méthodique*, Padue (vol.1 1778, section: 'Partie', p. 574. [L]

Montmort, Pierre Rémond de (1678 - 1719); tour in Ozanam 1725.

Montucla, Jean Etienne (1725 Sep 5 Lyons – 1799 Dec 18 Paris): Editor of editions of Ozanam's *Recreations*, 1750, 1778, 1790, problem 23, p.178–182. Adds the chevalier W. (1773) tour to the other three. [Singmaster][C][K4067][Hutton 1803]

Moon, (Rev) R. *Cambridge Mathematical Journal* ser 1 v.3 #17 Feb 1843 'On the Knight's Move at Chess' p.233-236. Method of annuli applied to square boards of any size. Index diagram for 8×8 board with outer borders lettered a, b, c, d and central 4×4 A, B, C, D (Collini 1773). Suggests the sequences aDbCdAcB or aDcBdAbC. No actual tours. 'If the number of squares in the board be odd, the same principle of division obtains. We shall still have a central square, which will have either five or seven places to a side, as the case may be, and a series of annuli divisible into circuits. It will be found, however, that in this case each annulus will consist of only two circuits, by reason of which the process is much simplified'.[C] [O RSL:1838–45 Per.1875 e.62.]

Moore, G. L. [there is a regrettable lack of biographical information on this author]; *Demonstration* (that there are only two possible diametral knight's tours with eight three-move lines in each) five-page ms 18 Apr 1918. *The Knight's Tour* 1920 a 30-page ms. (1) History and Euler's method. (2) Discussion of types of symmetry, including 'combined' examples by Bergholt from *BCM*. (3) Closed tours on 3-rank boards, including the four symmetric tours 3×10 and one example 3×14 with direct symmetry. (4) Impossibility of closed tours on 4-rank boards. (5) Tours 8×8 with three-move lines in given positions. (6) The five quatersymmetric tours 6×6. (7) Quatersymmetric tours on 8×8 omitting four squares in all nine possible positions. (8) Investigations of maximum symmetry in tours 8×8 and on 80-cell cross. *Supplement* 4 Dec 1920 (21 pages, mainly diagrams) seeks to enumerate symmetric tours with six three-move lines. [mss among Murray's papers.] Some results on 60-move tours with QS reproduced in *The Games and Puzzles Journal* (vol.2 #13 p.214 May 1996**).**

Moricard, Bernard: tour with maximum right angles in P. Berloquin *Jeux at Strategie* 1982 'Manoeuvres de Cavalerie'.

Moschopoulos, Manuel (born c.1265) Constantinople. Wrote a work on magic squares. c.1315. This includes a description of a particular case of the step-sidestep method of construction for odd-sided magic squares. Beginning with 1 at the cell below the centre move diagonally down to the right. When you meet the edge of the board you reenter at the opposite edge. When you meet an already used cell you move two cells downwards and then resume the diagonal moves. This results in all the ranks and files and the two diagonals adding to the same sum. He also describes a second method for odd sided squares in which the start cell is the one in the middle of the top rank, the step is a knight move down to the right, and the sidestep is a move of length 4 units downwards. He gives examples of size 3, 5 and 7. The 3 case being of course identical to the 3×3 square. (In the manner of the time, he describes the knight move as 3 down and 2 across, and the down step as of five squares, since he includes the first cell in the count in each case. It should also be noted that he does not use the terms knight or magic.) His methods for even-sided squares cannot be described in terms of tours.

Muhammad-Khan, Shir: *Sardarnama*, ms, 1798. Described by Murray as Persian, but written in central India. Contains the Nilakant-ha tour. [Murray, 1913, p. 65 footnote and p. 181]

Müller, F. M. *Sacred Books of the East* vol.16 (*The Yi-King*) Oxford University Press 1882 The 3×3 magic square. [Cited in Claude Berge *Principles of Combinatorics* 1971 p.11.]

Müllner, — von in *Literatur-Blatt* #39, (1824 May 14) and #40 (1824 May 18) [L] and in *Algemeiner Lit. Zeitung* (#183 p.625-632 and #184 p.633-639 Aug 1825) [L] [C]; also in *Schachzeitung* 1858. The *ALZ* article is supposedly a review under the heading 'Mathematik' of Warnsdorf (1823) but the original contributions by Warnsdorf are in fact passed over. He outlines the work of mathematicians who have contributed to the subject (Montmort, Moivre, Mairan, Euler, Vandermonde). The Chevalier W. tour is shown in large geometrical and small numerical form, and Euler's small 12-cell cross tour, followed by an account of the Euler - Bertrand method of modifying tours and Vandermonde's use of coordinates. In the second part a tour very similar to Moivre's is given in numerical form and is transformed into a closed tour by Euler's method.

Murray, Harold James Ruthven (1868 Jun 24 - 1955 May 16 Midhurst).

His extensive work on tours exists in numerous short articles in chess magazines and in extensive unpublished manuscripts as well as in his pioneering *History of Chess*.

The British Chess Magazine has included numerous items from 1902 to 1949, as listed here.

BCM (1902 vol 22 p.1-7) 'The Knight's Tour, Ancient and Oriental' §1 Considers Rudrata's 4×8 the earliest tour. §2 Diagrams two reentrant 8×8 knight's tours, two alternating-move tours (dated 10th to 12th centuries), and two knight puzzles (dated 1257) from Arabic manuscripts, noting the various methods of presentation of the tours. §3. Mentions the Persian ms in the Royal Asiatic Society. §4. Knight's tour in Anglo-Norman ms. §5. Five 4×8 tours in European chess manuscripts, including Guarini and Gianutio. §6. The Nilakant-ha tour.

§7. Modern Indian tour omitting four corner cells of each quarter (consists in effect of four copies of Euler's small cross-shaped tour linked together);

BCM (1911 vol.31 p.417-422, 466) 'The Knight's Tour on the Half-Chessboard' Duplicates the work of Sainte-Marie 1877 apparently without knowledge of the previous work, but his counting of the tours is erroneous.

BCM (1917 vol.37 p.305–9, 355, 392) 'The Knight's Tour on the Half-Chessboard' Revisits his article of 1911, but totals are still incorrect. Gives four partially magic tours formed by joining half-board tours. Makes interesting use of a cryptotour p.309. Corrects misprints p.355. Letter from E. Bergholt citing Sainte-Marie and Laquière and reply from Murray p.392 His total 7772 now agrees with that of Sainte-Marie, but disagrees (wrongly in my view) with Laquière.

BCM (vol.65 1945 ¶6823 p.228, sol p.274-5). "To the Greek cross tour [¶6781] H. J. R. Murray has added an extra condition: Dividing the board into 16 blocks 2×2 knight's move from such a block to a diagonally adjacent block is termed a 'slant' (in contrast with moves to orthogonally adjacent blocks termed 'straights') Complete the Huber-Stockar tour with the minimum of 16 slants in the tour." This is the first mention in print of the straights and slants terminology. Solution by Murray and S. H. Hall.

BCM (1949 vol.69 Dec p.397-400) 'The Classification of Knight's Tours' This gives the first full account of the 'straights' and 'slants' terminology and method. See also *FCR* 1949.

A History of Chess Oxford University Press 1913 (reprinted 1962, 1969) Rudrata c.900 p.21-22, 53-55, Nilakant-ha c.640 p.64-65, Ch.10 on the Arabic and Persian Literature of Chess p.169-183, Tours from al-Adli and as-Suli etc p.335-337, King's Library ms and its tours p.579-582, 589, Civis Bononiae mss and tour p.643–648, 674, Chachi ms and tour p.727, 730.

Problemist Fairy Chess Supplement (vol.2 #16 Feb 1936 p.166) 'Beverley's Magic S-Tour and its Plan'. By analysing Beverley's tour Murray formulated his idea of 'contiguous contraparallel chains' and found all 14 tours of this type. These tours appeared in every issue up to Feb 1937 (the title having changed to *Fairy Chess Review* in Aug 1936). He later found that only four of these were new, not twelve as he had supposed. The problem numbers are: *PFCS* #16 Feb 1936 p.166 ¶2107 = (27a Beverley 1848), ¶2108 = (27g), ¶2109 = (27m Francony 1882). *PFCS* #17 Apr 1936 p.177 ¶2239 = (27h), ¶2240 = (27s Reuss 1883), *PFCS* #18 Jun 1936 p.187 ¶2286 = (27q Reuss 1883), ¶2287 = (27r Reuss 1883).

Fairy Chess Review vol.3 #1 Aug 1936 p.3 ¶2350 = (27n), ¶2351 = (27o). *FCR* #2 Oct 1936 p.18 ¶2466 = (27p Reuss 1883), ¶2467 = (27l Francony 1881). *FCR* #3 Dec 1936 p.29 ¶2541 = (27j Béligne 1881), ¶2542 = (27k Francony 1881). *FCR* #4 Feb 1937 p.41 ¶2636 = (34d Ligondes 1883). In the historical sequence the new tours are H89-92. He found a further four new magic tours three years later: *FCR* vol.4 #3 Dec 1939 (the TRDFCR dated November 28) ¶4132 = (01f) ¶4133 = (12p) ¶4134 = (01d) p.43, #6 Jun 1940 ¶4556 = (03g) p.93.

Then he turned to larger boards: *FCR* vol.5 #1 Aug 1942 Five Minute Paper No.68 'A New Magic Knight's Tour' ¶5226 (a 16×16 tour by his Extended Quartes Method) p.2-3.

FCR (vol.7 #9 Nov 1949 ¶8368p.71-2, solution #11 Apr 1950 p.103) Five Minute Paper No.144 'Tours on the Slant' A short account of straights and slants with problem to construct a symmetric closed tour with 32 slants. Estimates no of tours with three slants at 13.5 million. Notes that closed tours have 32 slants maximum (cites example he published in *BCM* 1917) and gives new example, claims 1811 of these are symmetric. Notes there can be 34 slants in an open tour and cites example by Falkener.

FCR vol.9 #5 Aug 1955 gave a brief obituary p.44.

MS dated 2 Jan 1917 'Note on the combination of tours on the 5^2 board to form symmetrical tours on the 10^2 board' [*The Games and Puzzles Journal* vol.2 #13 May 1996 p.212]

MS Early History of the Knight's Tour c.1930 (date of most recent reference) includes extensive bibliography.

MS The Knight's Problem 1942. Covers all aspects of the knight's tour on boards of all sizes and shapes, including straights and slants and an attempt to enumerate all closed tours 6×6.

MS The Magic Knight's Tours, *A Mathematical Recreation* 1951 His methods of construction of magic tours are described in detail, including a complete catalogue of the 8×8 tours to date in both forward and reverse numberings. His numbering scheme for the tours is based on the underlying structure of the tours in terms of quartes. This includes the first 12×12 magic tour to

have one diagnal magic, dated 1947, although Murray may not have realised this, since he does not mention the property. He constructed magic tours up to 32×32. There is also a biographical note in this 1951 ms.

MS Miscellaneous. Following Murray's death in 1955 at the age of 86, many of his unpublished papers on tours (26 boxes) were deposited in the Bodleian Library, Oxford [shelfmark; MSS H.J.MURRAY 101-126]. However the three manuscripts (1930, 1942, 1951) were retained by his family until deposited at the Bodleian in 1992.

Board and Table Games From Many Civilizations by R. C. Bell, O. U. Press 1960 p.198-200 Mentions the existence of these mss, following a brief biography of H. J. R. Murray.

Games and Puzzles Journal reproduced some unpublished work (vol.2 #13 May 1996 p.212) the note of 1917. (#14 Dec 1996, #15 Dec 1997, #16 May 1999 p.238-244, 266-267, 291) 'H. J. R. Murray's History of Magic Knight's Tours'. Based on part of the 1951 ms with updates.

Murty, U. S. R. See *Graph Theory with Applications* (1977).

Mysore,, Krishnaraja Wodeyar III (Maha)Rajah of (1794 Jul 14 - 1868 Mar 27).

The third composer to construct a magic knight's tour on the 8×8 board He was also the first to construct a magic knight tour on the 12×12 board. He also did original work on figured tours. The Harikrishna ms (1871) reproduced in Iyer (1982) lists 76 tours attributed to the Rajah.

The spelling of the Rajah's name and titles vary considerably in different sources. The details above follow *Wikipedia* and *Indian Chess History* by Manuel Aaron and Vijay D. Pandit (2013 p.216-218). In *The Golden Book of India* by Sir Roper Lethbridge (1893 p.362-8) his name is given as Krishnaraj Wadiar. This tells how he was made Maharajah as a child, following the death of Tippoo at Seringapatam 1799. During his minority up to 1810 the state was administered by a 'Diwan' Purnaiya. Krishnaraj was deposed in 1831, remaining as titular ruler, so evidently had time thereafter to devote to other interests, including the investigation of knight's tours.

Murray (1951) wrote: "It was not known in Europe until 1938 that Indian players had also busied themselves with magic tours and that a closed unsymmetrical magic tour had been discovered in Mysore on 31 July 1852. A contemporary silk handkerchief bearing this tour, which it ascribed to Maharajah Kristna Rajah Wodayer Bahaudah, the Rajah of Mysore, was exhibited at the Margate Easter Chess Congress, 1938. The tour is also given in N. Rangiah Naidu's *Feats of Chess* 1922; it had been independently discovered by Francony in 1881."

Another sighting of this silk was reported by Major J. Akenhead in a letter dated 12 March 1947 to *Fairy Chess Review* (vol.6 #11 Apr 1947 p.84): "I was in Mr A. Hammond's (Emil, Burlington Gardens) yesterday and found that he had a piece of silk framed on which was a magic knight-tour invented, as the wording stated by Maha Rajah Kristna Rajah Wodaye, Behauder Rajah of Mysore, on 31st July 1852. I enclose a copy."

The silk was most recetly in the care of Jon Crumiller of Princeton, New Jersey, USA and was on display at the World Chess Hall of Fame in St Louis in 2013. His 8×8 magic tour is (00b) in our catalogue. On the silk the cells on the diagonals of the quarters are shaded black, unlike our usual chequering, that is the diamond quartes are dark and the square quartes light.

Further compositions by the Rajah, some including versions of the 8×8 magic tour, have since been discovered through work by Rangachar Vasantha in the Jayachamarajendra Art Gallery in Mysore and Maria Schetelch in Leipzig. These include two tours on the 18×18 board that include 8×8 and 12×12 sub-tours. See pages 189 and 321.

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Nadim, ben Ishaq, an-: *Kitab al-fihrist* 988. A bibliography which has a section on chess in which the al-Adli (c.840) and as-Suli (c.900) books are listed. [Murray 1913]

Naidu, Sammete Rangiah: *Feats in Chess* (T. Ramakrishna & Sons: Secunderabad, India 1922, viii + 55, with two plates), Ch 2 contains 100 diagrams of tours on the 8×8 or portions thereof, also the 12×12 and a T-shape of 80 cells. Review in *British Chess Magazine* vol.43 (1923) p.468. [Murray 1930 and 1955 §126] Also Urdu and Telugu editions [K4113/4/5]

Nami of Guzerat: Commentary (1069) on Rudrata's *Kavyalankara* (c. 900).

Nash-Williams, Crispin St.John Alvah (1932 Dec 19 Cardiff - 2001Jan 20 Ascot) *Proceedings of the Cambridge Philosophical Society* 1959 'Abelian groups, graphs and generalised knights'. And other papers on Hamiltonian cycles.

Neal, T. H.: *Chess Amateur* (vol.2, 1907/8, p.276, 370) 'Chessboard Puzzles' series conducted by C. Planck ¶12. King tours of first two ranks, gives formulae in terms of Fibonacci numbers. On 2×8 there are 8576 routes from a1.

New Recreations with Magic Squares by William H. Benson and Oswald Jacoby (Dover Publications 1976). Includes the Frénicle catalogue of 4×4 diagonally magic squares.

Nicolai, Nicolas de: c.1325. The scribe of a Latin manuscript of the first half of the 14th century in the Bibliotheque de Paris is a version of the Bonus Socius chess problem collection. He is identified as a scholar from Picardy who studied and lectured at the Lombard universities. [Linde 1874 p.245, 292-5; 1881 and Murray, 1902, 1913 p.643-8, 674; 1930] He presents a knight's tour problem in the form of an arrangement of the 32 chessmen in half of a chessboard. The white knight in one corner is to capture all the other officers except the kings, and then all the pawns and finally the two kings. The first half of the tour is determinate, but the sequence of capture of the remaining pawns can be varied, giving six solutions. See the 4×8 tours section.

Nilakantha (Bhatta): *Bhagavantabaskara*. This is a work on ritual, law and politics which according to Moriz Winternitz (*History of Indian Literature* p.607, extract in Google Books) was written at the command of the Rajput prince Bhagavantadeva in about 1640. The title means 'Sun of Bhagavantadeva' and the work is divided into 12 books called 'Mayukhas' meaning Rays. It has a section on chess at the end of the fifth book, which includes one tour, presented in three different ways, numbered from different points, the first two cases being attributed to Nilakantha's ancestors in Sri Lanka. The Sanskrit scholar Maria Schetelich, whom I met in 2018, informs me that a much earlier source for this tour is in *Yantracintamani* by Damodara Bhatta (c.1550). The name 'Bhatta' being a title signifying a scholar.

Nivernais, Ernest: 'La Bibliothèque de M(onsieur) Adam' *Strategie* (1868 p.246-251). Review of Adam (1867). [L]

Nixon, Dennison (1912 Dec 13 - 1993 Nov 11 Middlesbrough) *Fairy Chess Review* (vol.6 #4 Feb 1946 p.23, sol #5 Apr 1946 p.33) ¶6661-6663 Square numbers on cells in T, R, D, letter shapes.

Nouvelles Annales de Mathématiques 1852-4 'Sur le Problème du Cavalier au Jeu des Echecs' Par un Abonné {subscriber} (Terquem et Gerono, Paris vol.11 1852 and vol.13 May 1854 p.181-6.) Cites Legendre *Theorie des Nombres* 3rd edition. Has one irregular tour formed by Euler's method from a random partial path. Editor cites Euler, Vandermonde, Moon, Ciccolini. [M][C].

Nouvelle Notation (1823 p.439-449) 9 tours, one from Monneron (1776). [L]

Nuova Enciclopedia Populare Italiana (5th edn Torino 1864 vol.20 p.629) Euler [L]

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Observations et remarques ..., anonymous ms (c.1800?) in the White Collection [C] Not seen by me.

Onitiu, Valeriu (1872 Apr 8 - 1948 Dec 31 Romania) *Problemist Fairy Chess Supplement* (vol.1 #12 Jun 1932 p.74, sols #13 Aug 1932 p.82) ¶452-455 Tours with ten three-unit lines. Reports having examined all 1330 possible cases and only six admit tours. The editor Dawson wrote: "My only regret is that the cost of printer's blocks prevents me giving the rare fruits of VO's magnificent research on line diagrams as they ought to be given" *Fairy Chess Review* (vol.4 #3 Dec 1939, the TRDFCR dated 28 Nov 1939, p.43, sol #6 Jun 1940 p.93) ¶4135 The unique symmetric tour with squares in a knight chain.

Oppen, Otto Heinrich Alexander von (1783 Apr 13 - 1860 Apr 13). *Schachzeitung* 'William Beverley's Rösselsprung' (1849 vol.4 p.21–24) [A] 'Rösselsprung' (1858 vol.13 May, p.174–175). Prompted by Jaenisch he published three magic tours (00m, 12e, 12m) that Carl Wenzelides had sent to *SZ* in 1849 but were not published owing to the death of the previous editor, Hanstein. 'Zur Theorie des Rösselsprungs' (1858 vol.13 Dec p.489-492). There is mention

in one of these articles of work on magic knight's tours by Prof. A. F. Svanberg, with similar results to Wenzelides, but not published.

Orme, C. E. (before 1911) I"ve not traced anything by this author! [cited by G. W. Cutler]

Othman, Muhammad ben Hawa ben: 1221 ms with second as-Suli tour. [Murray 1913, p.174-5].

Oxford Companion to Chess 1984. by Kenneth Whyld and David Hooper. Extensive information on the history of Kempelen's Automaton. Knight's tour and magic square entries.

Ozanam, Jacques (1640 Boligneux, Brescia - 1717 Apr 3 Paris) *Recreations Mathematiques et Physiques* ... first published in 1694. This title continued to appear in numerous revised and translated editions, under various editors and publishers until the mid-nineteenth century, and Ozanam's name continued to be associated with the it. French: Montucla 1750. 1778, 1790; Grandin 1820, 1825, 1835; English: Hutton 1803, 1814, 1840; Riddle 1844. A history of it is given by Rouse Ball (1939, p.2-3). The edition of 1725, published in four volumes in Paris by Claude Jombert, is the first to contain the three knight's tours (vol.1, p.260–9) by the mathematicians **Pierre Rémond de Montmort** (1678-1719), **Abraham de Moivre** (1666-1754) and **Jean-Jacques d'Ortous de Mairan** (1678-1771).

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Palamède; pen name of Count Ligondès.

Pandit, **Vijay D.** See *Indian Chess History* (2013).

Papa, (Colonel) Ugo: 'Il problema del Cavallo degli Scacchi' *La Scienze per Tutti* {Science for All} a fortnightly review (vol.27 #16, 15 Aug 1920, p.241-244). Makes an attempt to count the tours on small rectangular boards in a systematic way, though with limited success. Translated by H. R. Bigelow as 'The Problem of the Knight's Tour' *Chess Amateur*, Half Hours section, 1922. Part 1, Jul 1922, p.315–6. §1-2 Historical sketch. §3–5 On counting of tours, with attention to symmetry, on square and rectangular boards of any size. §6 Open tours with central symmetry, constant sum N+1, with 5×7 example. Part 2, Aug 1922, p.345–7. §7 Closed tours with half-turn symmetry and constant difference ½N, example 6×6. §8 Closed tours with 'double diametral' symmetry; exactly five on 6×6, two diagrammed. §9 Closed tours with 'central diametral' symmetry (i.e. Bergholtian) add to N+1, example 5×8. §10 Closed tours with axial symmetry, example 5×6. §11 Bipartite tours formed of two equal components. Open and closed examples 6×7. §12 Magic tours, example (12a). §13 Euler's 20-cell cross tour. §14 Mentions transforming the board into a cylinder or sphere, and Vandermonde's 3D tour 4×4×4. Part 3, Sep 1922, p.378–9. §15–16 Methods of enumerating tours without duplications in terms of symmetry, in terms of primitive squares from which the tours must start. §17–19 Analysis of tours on 4-rank boards, but results are not accurate. Part 4, Oct 1922, p.22–23. §20–23 Tours on small boards continued, all rectangles with both dimensions less than 9 considered. The results are unfortunately not correct. Part 5, Jun 1923, p.287 is a continuation of the article, consisting of added material by *Chess Amateur* contributors on estimating the number of 8×8 knight's tours. See T. R. Dawson, F. Douglas, H. A. Adamson, O. T. Blathy. [BCPS Library]

Parmentier, (General) Joseph Charles Théodore (1821-1910); *Association Française pour l'Avancement des Sciences*, Congres Marseilles 1891, Pau 1892, Caen 1894 (Aug 11). 'Chronologie des marches du cavalier aux échecs conduisant à des carrés semi-magiques' Au Secrétariat de l'Association 1897. Catalogues all known magic tours to date. [K4098/4100/4101] [Kraitchik 1927 p.3] [Rouse Ball 1939 p.174] Review in *La Strategie* (vol.32 1895 p.213) [note from D. Pritchard]

Passatempo, Il: 1867 (2 vols Bologna 1867-69) [C]. I have only located one issue of this puzzle magazine online, dated 15 Feb 1867. It has an attractive near-biaxial tour in geometrical form.

Pauly, Wolfgang (1876-1934) Romanian Problemist. *L'Echiquier* Dec 1930 'Echecs Feeriques' ¶186 p.1085 (sol Jan 1931 p.1150 in coordinate form). Longest nonintersecting closed knight path of 32 moves on 8×8. (See p.712) [Not the Austro-Swiss physicist Wolfgang Pauli (1900 - 1958).]

Pearson, (Rev) Arthur Cyril (1838 Jan 9 Springfield -.1916 Nov 8 St Leonards-on-Sea); *Twentieth Century Standard Puzzle Book* (London 1907, 1915). Selected from a column in *The Evening Standard*. Knight tours on pages 83–90 of part 1 (visual patterns), p.86 of part 2 (6×6 tour) and p.31, 33–34, 37 and 118–121 of part 3 (cryptotours). Frog {0,3}+{1,1} puzzle is on cover and pages 62 and 131 of part 3. The two-stars tour is from Gorgias (1871) without acknowledgement, the Marble Arch tour is very similar to one by Crétaine (1865), the Lazy Tongs tour may be new. [My own copy]

Pennick, Nigel: *Mazes and Labyrinths* 1990.

Perenyi, L. *Mnemonik des schachspieles: oder, Versinnlichung des bretes und der zuge*, Wien 1842 'Rosselsprung uber alle 64 Felder nach viermal vier gleichen, geometrischen Figuren' p.30-34. Tafel 30 is the squares and diamonds pattern, but no tours of this type are shown. The next to last page has the Gianutio (1597) tour joined to a copy of itself on upper and lower halves of 8×8 board in numerical form. [Haldeman 1864][Google Books]

Perigal, Henry: Letter introducing Beverley's tour 1848.

Petkovic, Miodrag: *Famous Puzzles of Great Mathematicians* (2009). American Mathematical Society (includes tour in Euler letter to Goldbach 1757).

Pfennig-magazin der Gessellschaft 'Das Schachspiel' (F. A. Brockhaus publisher, Leipzig 1834, vol.2 #70, p.551-2, 559-60) [C] [L gives date as 1841] Not seen by me.

Planck, (Dr) Charles (1856 Nov 1 Dhiapore - 1935 Jun 18 Haywards Heath)

The English Mechanic 1888 Article describing 4D magic 3×3×3×3.

British Chess Magazine 1900 Mar 1 'The N Queens Problem' includes 'chess magic square' and attributes the term Caissan Squares to the late Henry Jones ('Cavendish') [Bidev 1986]

The Theory of Path Nasiks (A. J. Lawrence Rugby 1905) a theory relating to magic squares.

Chess Amateur editor of 'Chessboard Puzzles' series (1907-1910: vol.2 ¶1-17; vol.3 ¶18-44; vol.4 ¶45–55). ¶1: p.52, 82, routes of Ke1 to e8 in 7 moves = 393. ¶12: p.276, 370, king tours of first two ranks by T. H. Neal. ¶25-6, p.83, 147, Knight tours of 5×5 by C. Planck total 1728. ¶28, p.115, 179, rook tour in 15 moves a1-a6, by T. R. Dawson after J. R. Mattey. ¶31, p.179, Guarini's problem. ¶32, p.179, Euler symmetric knight tour in two half-boards. ¶50, p.83, Knight 6-move routes from a1. [BCPS Library]

Plödtiels, Ignaz: ms *Versuch einer allgemeinen Lösung des Rösserlsprunges ...*, Berlin 1834, was in collection of R. Franz. [C]

Poirson-Prugneaux, Q. *Introduction Pratique du Jeu des Echecs* 1849 'Probleme Du Cavalier' p.316-331. Shows 13 tours by naming the successive cells visited using abbreviated descriptive notation, one tour to a page. He gives examples by Moivre, Mairan, Montmort, Euler (= his first closed tour), Monneron (= Nilakantha), un Malabare, Dictionnaire des Mathematiques (= Euler's first open tour), Vandermonde, Collini, Ciccolini (two), Palamede (= Jules de Poilly cryptotour), and Troupenas. This short treatment seems to have led later commentators to ascribe the squares and diamonds method to Ciccolini (1836). [Lucas 1895] [Google Books]

Poilly, Jules de : 'Une des Marches du Cavalier aux Echecs' *Le Palamède* (Paris, Jun 1842, ser.2 vol.1 p.322). Presents a knight's tour 'cryptotour' in which a verse written on the cells is to be read in the sequence of the knight's moves. This type of puzzle appears to have begun here in *Le Palamède* which was the earliest magazine solely devoted to chess. See Cryptotours.

Polignac, Camille de *Comptes Rendus de l'Académie des Sciences* (Paris vol.52 #17. 19 Apr 1861 p.840–842) 'Sur la Course du Cavalier au Jeu des Echecs'; *Bulletin de la Société Mathématique de France* (Paris vol.9 1881 p.17-24) 'Note sur la marche du Cavalier dans un Echiquier'. [A] [C] *Cosmos: Revue Encyclopédique Hebdomadaire des Progrès des Sciences et leurs Applications aux Arts et l`Industrie* Tramblay Paris v.18 1861 p.489 is a review of Polignac. [C]

Pollard, T. Gordon *British Chess Magazine* (vol.65 1945 p.79, sol p.129) ¶6649 monogram tour for TRD/awson. *Fairy Chess Review* (Oct 1945 p.7, misnumbered 147, sol Dec 1945 p.18) ¶6540 tour delineating a Victory Vee (5 V's in fact) (vol.6 #9 Dec 1946 p.65, sol #10 Feb 1947 p.74 in text) ¶7094 monogram tour for WHC/ozens.

Pongracz, Arnold (Graf zu Balassa Gyarmath) (1811 Jul 18 - 1890 Jul 7): *Wiener Schach-Zeitung* (1855 p.238-241) 'Rosselsprunge' [M] [online] Symmetric closed tour (hk type) that joins tours of two irregular-shaped half-boards. (See p.471.)

Ponziani, Domenico Lorenzo (1719-1796); *Il Giuoco Incomparabile degli Scacchi* (1st edition Modena 1769). A 1782 edition is mentioned by Meyer 1873. Rome edition 1829, p.29-30. [L] Quotes Ozanam's *Recreations*.

Porreca, G. See *Dizionario encyclopedico degli scacchi*.

Post, —: tours on small shaped boards, See *L'Echiquier* 1928-9.

Pozzi, Rodolfo. 'The Mongolian and Tuvinian Chess Sets and their Symbolism' in *8th Convention of Chess Collectors International* (Vienna 19-24 May 1998, Fig.11) [Copied to me by Mike Pennell, 16 Jan 1999] Has illustrations of games pieces including the Lewis and Tuvinian chess pieces, showing Celtic knots going alternately over and under, including 4×4, 5×5 and 8×8 forms.

Price, B. D. *Mathematical Gazette* Oct 1961 Note 2954 in response to 2761 by W. H. Cozens, with diagram of 6×6 binary tour and pseudotour.

Problemist British Chess Problem Society (1918-). Tours: Jelliss (1978), Marlow (1988).

Problemist Fairy Chess Supplement (1932–6) edited by T. R. Dawson. Tour contributions by H. A. Adamson, F. Dignal, F. Douglas, R. J. French, G. Fuhlendorf, A. H. Haddy, Dr S. H. Hall, Frans Hansson, D. H. Hersom, W. Jacobs, A. H. Kniest, W. E. Lester, H. J. R. Murray, V. Onitiu, W. H. Reilly, P. C. Taylor, E. J. van den Berg. Continued as *Fairy Chess Review*.

Pruen, (Rev.) Thomas: *An Introduction to the History and Study of Chess* by an Amateur (Cheltenham 1804, p.49-50). The Moivre tour, presented by numbering the cells a8-h8 as 1-8 and so on, so the tour visits the cells 8-23-40-55- ... -19-29-46. [M] [Google Books]

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Quack, J. de: See Mauvillon.

Quignano, Anselmo T. *Saltos del caballo; Problema de Ajedres*. 1853. [C]

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R—, J. *Deutsche Schachzeitung* (vol.28 1873 p.283) 'Eine Rösselsprungs-Frage'. [A.]

Rädell, (Dr) Carl: *Schachzeitung* vol.3 1848 'Uber die mathematische Behandlung des Schachspiels' p.101-120. describes moves of the pieces but no tours I could discern. {A}[L] *Mathematische Schachfragen* 1863 p.97, 172, 203, 363, and 1864 p.48, 78.[L]

Read, R. C. 'Constructing open knight's tours blindfold!' *Eureka* #22, 1959. Roget with refinements.

Receueil de differentes figures .... anonymous ms c.1800? in the J. G. White Collection [C]

Rees, G. H. J. van 'Knight's tours and circuits on the 3×n chessboard' Classroom Notes *Bull. Inst. Combin. Appl.* #16 (1996) p.81-86. Very elementary treatment.

Régnier, A. *Les Mondes* (vol.32 1873 p.507-514) 'Problème de la Marche du Cavalier'. [A.]

Reid, M. in *Journal of Recreational Mathematics* 1993.

Reilly, William Henry (1892 Oct 5 Salford -) *Problemist Fairy Chess Supplement* 1935 (?). *Fairy Chess Review* 1947 tour showing four stars centred at b7 d2 g7 h3. (vol.7 #2 Oct 1948 in text p.13, misnumbered 105, sol #3 Dec 1948 p.22) ¶7868 Monogram tour showing 1948.

Reuss, Charles Emile (1822 Feb 24 - 1889 Nov 16) alias 'X à Belfort'; Professeur de mathématiques et physique aux Lycées de Nevers et Belfort, émérite 1884 [biographic details from Geneanet]. Four new magic tours in *Le Siècle* Oct-Dec 1880: (00j) = ¶1252 *Le Siecle* 5/12 Nov 1880, (27f) = ¶1258 *Le Siecle* 12/19 Nov 1880, (27e) = ¶1270 *Le Siecle* 26 Nov / 3 Dec 1880, (00d) = ¶1276 *Le Siecle* 3/10 Dec 1880. Another four (27pqrs) found in 1883 according to Murray, but I have not found where they first appeared. Also a 4-giraffe magic tour in *Le Siècle* 12 March 1887.

Richmond, Paul: *An Annotated International Bibliography of Chess Articles in Non-Chess English-Language Periodicals* 1975.

Riddle, Edward (1788 Troughend - 1854 Mar 31 Greenwich) *Recreations in Science and Natural Philosophy* 1840, 1844, 1854. English editions of Ozanam's Recreations. [C]

Riihimaa, Olavi: See *Schach und Zahl* (1978).

Rilly, A. *Le Problème du Cavalier des Echecs* Troyes 1905. Two 32-move circuits linked by a 3-step rook move to form a diagonally magic square. [Rouse-Ball 1939 p.185]

Rixey, Fred *Jumblegrams* (Wright Press, New York 1927). Consists of 30 puzzles on a 6×6 board. Often there are blank squares, so the path length may be less than 36. Answers are not given in the book, but were available on writing to the publishers. The first problem uses a quotation from Horace. [details from D. E. Knuth]

Roberts, Timothy S. (Central Queensland University, Australia) *Games and Puzzles Journal* #25 (online) Jan-Feb 2003, 'A New 8×8 Magic Knight's Tour' and 'Another New 8×8 Magic Knight's Tour'. Tours (01i) and (14e). The results were also reported in *Mathematical Gazette* (Mar 2005) 'The discovery of two new magic knight's tours' p.22.

Roget, Peter Mark (1779 Jan 18 Soho, London – 1869 Sep 12 West Malvern). This is the same Roget who was Secretary of the Royal Society for over 20 years (1827-49) and later (1852) published the famous *Thesaurus*. 'Description of a Method of moving the Knight over every square of the Chessboard without going twice over any one; commencing at any given square and ending at any other given square of a different colour' *The London and Edinburgh Philosophical Magazine and Journal of Science* (ser.3 vol.16 Jan-Jun 1840, Apr p.305-309 and plate facing p.305). [C] [O GenPer27] [K4073] See History p.344. The method of squares and diamonds probably led Roget to his method. Some tours of squares and diamonds type are Rogetian, but there are many that are not, and moreover most tours constructed by Roget's method are not of squares and diamonds type. Nevertheless, the conflation of Roget's method with the squares and diamonds is a story which has become almost ineradicable from the literature. This misunderstanding of Roget was pointed out by 'E. H.' in the *Glasgow Weekly Herald* 1873, where he criticises an account given in the *Westminster Papers* (which he satirises as the *Wastebasket Papers*). The confusion may have originated in Charles Tomlinson's treatment of the subject in *Amusements in Chess* 1845, or the account in Crétaine's *Etudes* 1865.

Rohr, H. Monogram tour 'CEF' in *Cahiers de l'Echiquier Francais* 1928 p.388.

Rothe, (Prof), —; see Glaszer 1841.

Rouse Ball, Walter William (1850 Aug 14 London - 1925 Apr 4 Cambridge); *Mathematical Recreations and Problems* Macmillan and Co London 1892. I'm not sure if this first edition contained knight's tours. Subsequent editions were issued as follows: 2nd 1892. 3rd 1896 [This has subtitle ... *of Past and Present Times* Ch.7, has Hamiltonian game p.162-5, Knight's path p.165-177, use of 'cells' for the squares of the board p.165; tour cited as 'Roget's Solution' is the Troupenas (1842) tour of squares and diamonds type. [Leicester University Library] 4th edition 1905, 5th 1911, 6th 1914, 7th 1917 [This has a biaxial magic king tour, p133, according to T. H. Willcocks] 8th 1919, 9th 1920, 10th 1922 (reprinted 1926, 1928, 1931, 1937). For 11th and subsequent editions see Coxeter.

Rowland, Thomas B. (1850 Jun 1 - 1926) and **Rowland, Frideswide F.** *Chess Fruits* 1884. This compilation, by a husband and wife team, includes four cryptotours. See Cryptotours.

Rudrata: *Kavyalankara* (c.900). A poetic work ascribed by Murray to the reign of Sankaravarman, 884-903. Including simple rook and elephant tours as well as a knight tour on the half-board, presented by syllables on the cells to be read in the sequence of the tour.

Ruemmler, Ronald E. *Journal of Recreational Mathematics* (vol.2 #3 Jul 1969 p.154-7) Letter on non-crossing knight tours. See Yarbrough for diagram.

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Sabel, P-L-B. *Heures de Leisir, Moniteur des Jeux d`Esprit et de Combinaissons* Paris 1880-81 [C]

Sachsen-Gotha, (Herzog) Ernst II von (1745-1804). *Reichs-Anzeiger* (18 Sep 1797 p.366-368)**.** This article has three tours, Figured, Symmetric half-board and Compartmental types, and sets a problem of constructing tours with the numbers 1, 17, 24, 44, 64 on the cells d5, e4, e5, d4, f4. Solutions to this problem are enumerated in a manuscript in his library, which still exists, with the title *Auflösung einer systematische Aufgabe der sogennannter Roesselsprungs auf dem Schachbrete* (dated 1798). All these tours are naturally rather irregular.

Sainte-Marie, C. Flye (Répétiteur à l'Ecole Polytechnique, according to Lucas 1894):

Bulletin de la Société Mathématique de France (vol.5 1876-77 p.144-150) 'Note sur un problème relatif à la marche du cavalier sur l`echiquier' (Séance du 18 Avril 1877) [C] [British Library] He notes that research on the number of knight's tours on the 8×8 board has presented great difficulties. Instead he proposes to count all possible tours on the 4×8 board. He divides the 32 cells into two groups: one group being formed of the white cells on the exterior ranks and the black cells on the interior ranks, the other being the remaining 16 cells. (By convention the top left corner is white.) He notes that a cell on an exterior rank will connect by a knight move only to cells of the interior ranks in the same group. So a link between the two groups must be between two interior cells. He proves that any tour must be open, must start and end on the first or fourth ranks, must be in two halves joined by a single move on the two inner ranks, the two halves being on the two fixed groups of squares. He goes on to show how the number of tours can be calculated from the numbers of half-tours. For the 4×8 board he correctly counts the half-tours 118 a2, 32 c3, 54 e2, 42 g3 and the full tours 118×32 + 32×54 + 54×42 = 7772, but does not diagram any actual tours.

L'Intermédiaire des Mathématiciens (Paris vol.11 Mar 1904 p.86-88). Partial answer to Boutin (1901), giving a recurrence formula for the number of closed wazir tour diagrams on rectangular board 4×y. [Leicester University Library]

Saukkola, Juha: *Games and Puzzles Journal* #20 (online) May-Aug 2001 'Nightrider Tours without Knight Moves'.

Sayles, Harry A. 'Two More Forms of Magic Squares' *The Monist* 1911 #21 (1):152-158. Also sections in Andrews *Magic Squares and Cubes* (1917),

Schach und Zahl by Eero Bonsdorff, Karl Fabel, and Olavi Riihimaa. Walter Rau Verlag 1966 (3rd ed 1978 p.50) non-crossing knight path 17-move 6×6 from Yarbrough et al (1968).

Scheidius, T. 'Het Problema van den Paardensprung' *Sissa* (1850 p.209-223) [L] [online] He gives an account of squares and diamonds tours with three example tours, two being symmetric double-half-board tours (of types M e-g and N c-e in my catalogue). These are the first of this type known (though there may be some hidden in the Lavernède catalogue). The full-board squares and diamonds tour is asymmetric but can be regarded as derived from a pseudotour of four circuits of two types with oblique quaternary symmetry (the same tour is in Jaenisch 1862). There is also a Collini-style example, with two successive internal and external paths (type IIOIOOIO). Page 217 has a table which may be a count of tours.

Schetelich, Maria: 'Schach' p.5-36 and Ute Rettberg 'Chaupad' p.37-60. *Das Schach und seiner asiatischen Verwandten* (Ausstellung des Museums for Volkerkunde Dresden).2008. Includes photos p.20-21 of Raja of Mysore's 18×18 tours foumnd in Leipzig.

Schinnern, Clemens Rudolph Ritter von: *Ein Dutzend mathematischer Betrachtungen* {A dozen mathematical contemplations} (Geistinger, Vienna, 1826, with preface dated 1825, 36 pages). This curious little 36-page booklet gves the first full exposition of the 'squares and diamonds' method. David Singmaster found a copy of this for sale actually in Vienna in Feb 1996 (with some pages still uncut!) and I am grateful to him for a photocopy of this, together with notes on the other 11 questions, which range from geometrical constructions to the relation of luck to skill in card games. The article on tours is: 'Die Formeln für den geometrisch-aritmetischen

Rösselsprung' (p.16-29). The formulae referred to indicate the sequence in which the quarters are visited and whether the moves within them follow a square (*quadrat*) or diamond (*rhombus*) path. See Squares and Diamonds history section p.342.

Schmitt, E. A. 'Paardensprong-raadsel' {Knight's tour enigma} *Sissa* p.330 gives a Dutch cryptotour with a single letter in each cell, some of them being capitals. See Cryptotours.

Schubert, (Prof. Dr.) Hermann Caesar Hannibal (1848 May 22 Potsdam - 1911 Jun 20 Hamburg)
Monist 1892 article on magic squares;
Mathematische Mussestunden Eine Sammlung von Geduldspielen, Kunststücken und Unterhaltungsaufgaben mathematischer Natur. {Mathematical Pastimes: A collection of solitaire games, feats and entertaining problems of a mathematical nature} (Leipzig 1898. Ch.23, p.187-222) 'Rösselsprünge' §1 Introduction. Gives the Lucas (1882) formula for number of moves on p×q board in the form 2(2pq – 3p – 3q + 4). §2 History. §3 Euler and Vandermonde. §4 Collini. §5 Polignac and Laquière. §6 Sainte-Marie 4×8 and other small boards. §7 Magic tours, three examples (00m, 12e, 12m all by Wenzelides). §8 3D tours 4×4×4 and 3×4×6. (Ch.25, p.269-286) Hamiltonian problem. Later editions (2nd 1904, 3rd 1909 in 3 vols) keep the same content regarding knight's tours but different pagination. For 4th edition 1924 see Fitting.

Schuh, Fred(erik) (1875 Feb 7 - 1966 Jan 6): *Wonderlijke Problemen; Leerzaam Tijdverdrijf Door Puzzle en Spel* (W. J. Thieme & Cie, Zutphen, 1943) *Master Book of Mathematical Recreations* (English translation of 1943 book, Dover Publications 1968). Deals with pseudotours on small boards, and angles in closed knight tours.

Schwalbe German chess problem composers society and magazine (1924-). Tours: Cassani (1931), Brügge (1985, 1988).

Schwenk, Allen J. *Mathematics Magazine* vol.64 No.5 Mathematical Association of America 1991, 'Which Rectangular Chessboards Have a Knight's Tour?' p.325-332. This is devoted to a formal proof of Theorem: An m×n chessboard with m ≤ n has a knight's tour unless one or more of these three conditions holds: (a) m and n are both odd, (b) m = 1, 2 or 4, (c) m = 3 and n = 4, 6 or 8. Most of this was known to earlier authors (e.g. Frost 1876, Kraitchik 1927) but not expressed as a single theorem. His main innovation is to provide a method to extend tours from smaller boards to larger ones that works for all cases and is part of a proof using mathematical induction. Figure 9 in the paper shows "The nine Hamiltonian cycles that form the base of the inductive construction." These include an 8×8 tour with considerable border braids (almost any would do). The other tours are 3×10, 3×12, 5×6, 5×8, 6×6, 6×7, 6×8, 7×8. His 3×10 and 3×12 examples are among those known to Bergholt and Moore. His 5×6 example is the Haldemann solution. His 6×6 example is the quaternary one with a cross.

Scotland, Will = 'Alban'.

Scriba, C. J. see J. E. Hofmann 1988.

Secker, Jexon, J. *Chessics* (#5 Jul 1978 p.4-5) asymmetric tour with 17 straight angles and 8 three-move lines. (#7 Mar 1979 p.10). Tours with maximum angles.

Sède, Gérard de *L'Or de Rennes* 1967. Uses Euler's first closed tour. See Cryptotours.

Sharp, Archibald Regrettably biographical details of this author are lacking. He gives his qualifications as BSc, AMICE and FCIPA but my enquiries to these organisations elicited no reply. *Linaludo: The Knight's Tours, A Fascinating Game of Patience* (E. Marlborough & Co Ltd, London 1925, 32 pages). Includes the earliest example known of a 14×14 tour with birotary symmetry. His term for this is 'doubly symmetric'. Also a 60 cell birotary tour (cf Moore 1920). His tour diagrams are in the form of black dots connected by strong lines with no background squares, similar to Vandermonde (1771). The book was apparently accompanied by a sketch book of blank diagrams marked only with dots or small circles for the readers to construct their own tours. He recommends starting with 'six-square diagrams' i.e. 6×6 boards. The 'Introductory' says "For a fuller discussion of the subject the reader is referred to the Author's *Handbook of Linaludo: The Knight's Tours* which contains over 250 diagrams" but it seems this may never have been published. In the 'Brief General Instructions' he describes Euler's process of construction of tours from a random arrangement of moves in terms of 'transformation routes' of an odd number of moves composed of inserted and deleted moves alternately (in other words the

method of simple linking). The eventual result is either a tour or a superposition of circuits. He uses his own distinctive terminology for symmetry. He is mainly interested in patterns of knight moves that can be extended by repetition over larger and larger boards. Thus most of his resuults are pseudotours of two or more circuits. An original and neglected work.

Silberschmidt, Hirsch in *Das Gambit* 1829. Compartmental tour.

Simonot, Edmé: *Le Polygraphile décrit par son inventeur; la Polygraphile du Cavalier des Echecs*, Paris 1872. Contains a bibliography of over 50 authors, according to de Hijo (1882). [A][C] *La Strategie* 1872 p.113. Summary of the above. [L] *La Strategie* vol.5 'Un Merveille de Patience et d'Habilité' p.147-154. This is a review of Adam (1867). [B; shelfmark PP(Paris) 1831g.] [information from D. Pritchard]

Simpson, T. W. see 'Corinda'

Singmaster, (Prof.) David *Enumerating unlabelled Hamiltonian circuits* International Series on Numerical Mathematics (#29 1975 Birkhauser, Basel, p.117-130) estimate of 10^(23 ± 3) tours of 8×8 board. *Sources in Recreational Mathematics,* a preliminary edition 1987, 5th preliminary edition 1991 [website].

Singh, S. K. 'A 16×16 Diagonal Magic Knight's Tour' *Games and Puzzles Journal* #45 (online) Sep-Dec 2006, an irregular example.

Sissa, ***Maandschrift voor het Schaakspel***. This was a Dutch chess magazine, named after the inventor of chess in Persian legend. Issues appeared in 1847-1869, 1872, 1874. [L] The 1847 volume mentions Euler in footnotes. In 1848 'De oplossing van den paardensprong' p.150-153, 190-194, 213-218, 261-265 it gives some irregular tours illustrating Euler and Warnsdorf methods. A cryptotour is posed p.319, using words and some capital letters on the cells. The solution p.341 is in the form of an eight-line verse in rhyming couplets. Some of the letters refer to the chess pieces in Dutch notation. No tour diagram is given but it is a distinctive pattern with some diagonal symmetry. Also 1850 p.144 and 1853 p.39, 69, 89, 102, 138. [L] 'De Leer van den Paardensprung' p.7-13, 35-37, 1871. After Max Lange (1856). See Scheidius 1850, Schmitt 1849.

Slyvons, Edmond (alias of E. S. A. L. Solvyns) *Application de l'Analyse aux Sauts du Cavalier du Jeux des Echecs* (Brussels 1856). [C] [K4078/9] [Google Books but the plates are not folded out so only some figures can be seen] Proposed formulae for number of tours on n×n board in the form: S(closed) = n(n–1)(n–2)(n–3)(n–4)(n–5) (A+Bn+Cn²+...) and S(open) = (n–1)S(closed) but no clear derivation. He was the first to show a Greek Cross formed of 11 successive knight moves in a tour, and became known for tours with four corner stars, although this was anticipated by Laisement (1782). See Approximate Biaxial symmetry for diagram. Other tours with graphic and monogram features and two 10×10 closed tours.

Solvyns, E. S. A. L. see 'Slyvons'.

Somesvara III: King of the Kalyani area in central India *Manasollasa* c.1150. See History.

Sphinx*, *Le (1866, p.67) an account of Mercklein (1863). [L].

Sprague, T. B. *Edinburgh Math Soc*. 1891.

Staeker, — ms 1849. Two tours, similar to those shown by Käfer 1842, are quoted by Murray (1942) as "taken from the Staeker collection of tours, a MS (1849) now lost." The 'Figure Eight' shows approximate biaxial and the 'Corkscrew' approximate axial symmetry. The same source also had five tours on a 128-cell board of a type used for four-handed chess.

Stamma, Philip (c.1705-c.1755): *Essai sur le Jeu des Echecs* Editions 1737, 1741, 1750, 1770. Hamburg edition 1770, p.70-72. First use of modern 'algebraic' letter and number notation for chess, except that he used capital letters and put the number first. [C][online]

Staunton, Howard (1810 - 1874 Jun 22 London): Chess column in *Illustrated London News* 1870–74. [Hastings Public Library] [British Library] The column began 25 Jun 1842 and was edited by Staunton, the leading British chess player of his time, from 1845. In the 31 Dec 1870 issue he began a series of 16 cryptotours which attracted much attention, judging by the long lists of solvers. This was before the introduction of crossword puzzles. These are the first English examples I have found. They are numbered I–XVII, inadvertently omitting XII. His examples employ a wide range of literary quotations, especially from Walter Scott and Shakespeare, and even include examples in French (de Musset), Italian (Dante) and Macaronic verse (Porson). Any

connection between the verses used and knight's tours is slight and whimsical, except in the three cases I, V, XIV, where specifically chess related text is used. The series begins with the customary mention of Euler and Moivre. For a fuller account See Cryptotours. The 27 Jun 1874 issue, p.619, announced the death of Mr Staunton 'who for many years had charge of this column'.

Stchoulepnikoff, (Rev) Serge de: ms *Twenty solutions of the Problem of the Knight's Tour* Buffalo 1865 [C]; According to Browne (1870) this author 'in an unpublished paper on the subject of Knight's Tours, computes the number of possible solutions to be over 35,000,000,000'. ms *Numerate Tables of all Symmetric Tours Arranged with Quartes...* 1885 [C].

Stead, Walter: *Fairy Chess Review* 1954 (?). Notebooks 1974 a 5×5 knight + wazir step-sidestep magic square [copy from Philip Stead].

Stedman, Fabian (1640-1713): *Tintinnologia* 1668 and *Campanologia* 1677 on change ringing of bells. Interlacings like king tours can be seen in the simplest sequence 'plain bob minimus'.

Stein, Elias (1748-1812) *Manuel de l'Amateur de Jeu des Echecs* (Delarue, Paris, c.1850 p.132-138). 'Problême dont la solution a été donnée par M. Euler' Numerical diagrams of the first two Euler (1759) tours and the Moivre (1725) tour [C] [Google Books] [K]

Stenzler, Adolf Friedrich (1807-1887) *Monatsbericht der Königlichen Akademie der Wissenschaften zu Berlin* (Berlin 1874 p.21-26) 'Uber Nilakant-ha's Rösselsprung' [C]

Stertenbrink, Günther: See Mackay.

Stewart, J. *Journal of Recreational Mathematics* (vol.4 #1 Jan 1971 p.1) tour 8×8×8 stacking 8×8 tours [Cited by A. Kumar].

Stone, D. J. W. *On the Knight's Tour Problem, Solution by Graph-Theoretic Methods*. MSc Thesis. Dept of Computing Science, U of Glasgow, Jan 1969. Confirms Duby (1964) count of 6×6 tours.

Stonebridge, Brian R. *Mathematical Spectrum* vol.19 1987 'The Knight's tour of a chessboard' p.83-89; vol.25 1992/3 #4 'Knight's tours without Counts' p.106-109. Warnsdorf rule modified.

Stowell, T. P. *The Analyst* (Des Moines Iowa vol.6 #6 Nov 1879) 'Problem Relative to the Move of the Knight at the Game of Chess' [C]

Strategie, La 1895, vol.32, p.213, has mention of a brochure on knight tours by General Parmentier, presented at Caen. [information from D. Pritchard]

Styan, George. P. H. (McGill University) Caissan squares: the magic of chess. (preliminary version, revised, 2011, Oct 1. [PDF] Includes magic square by Kesson (1881).

Suli, Abu-Bakr Muhammad ben Yahya, as- (c.880 - 946). See History.

Sunyer, J. in *Fairy Chess Review* 1943.

Svanberg, (Prof) A. F.: *Schachzeitung* 1849 or 1858 (page unknown). Murray records: "In the same year (1849) the *Schachzeitung* announced that A. F. Svanberg, Professor of Mathematics in the Stockholm University, had also discovered four magic tours 'as a result of mathematical reasoning', but these were never published and are not to be found among Svanberg's papers now preserved in Stockholm. All that we know of them is that they were found later than Wenzelides's first tour and that one was 'concordant' with [it], whatever that may mean."

Syamakisora, —: *Risala i Shatranj* 1885. Tour both Rhombic and Rogetian. [Murray 1930]

Szachy od A do Z by W. Ladyslaw Litmanowicz and Jerzy Gizycki (Warsaw 1987 p.117-8) Skoczka problem 5×8, and 8×8 open tour with approx biaxial symmetry [details from P. Wood]

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Tabrizi: See Ala'addin.

Takefuji, Yoshiyasu (1955 -) *Neural Network Parallel Computing* (1992) Includes asymmetric tours 6×6, 14×14, 16×16, found by this process.

Tarry, H. *Les Mondes* (vol.28 1872 #2 p.60-64) 'Solution du Problème du Cavalier au jeu d'echecs, par M. Volpicelli' This review begins with some history, showing the Moivre and Chevalier W

tours and mentions Euler and Van der Monde (sic). He restricts his criticism to saying the methods of Volpicelli are very long and laborious. [A] [L] [C]

Taylor, P. C. [regret no biographic details] Lecture to the British Chess Problem Society 26 Feb 1932 is mentioned in *British Chess Magazine* (1932 vol.52 p.182). This lecture contained a large number of knight's tours, either of the squares in a chain, or monogram types. Most of them appear to have been later published over the years. Dawson presumably circulated examples of his idea of tours with squares in a knight chain among members of the British Chess Problem Society before actual publication, so as to stimulate other composers to try the idea. *Problemist Fairy Chess Supplement* (vol.1 #11 Apr 1932 p.64) ¶379 "PCT had two other tours in his BCPS lecture of Feb 26th with squares in knight chains" and (#12 Jun 1932 p.73) ¶448, closed knight tours with the square numbers in closed knight chains showing rectangle in two different positions. (#15 Dec 1932 p.95) ¶591 open knight chain with square numbers delineating D. (#17 Apr 1933 p.113) ¶717-9 from his 1932 lecture, the square numbers in open Giraffe chains. Monogram tours in *Fairy Chess Review* (vol.3 #11 Apr 1938 p.120) ¶3181 TRD/awson. (#12 Jun 1938 p.130) ¶3252 CMF/ox. (#13 Aug 1938 p.141) ¶3325 HAA/damson. (#14 Oct 1938 p.150) ¶3389 FRA/dcock, (#15 Dec 1938 p.159) ¶3466 WHR/eilly. (#16 Feb 1939 p.175) ¶3590 HAR/ussell. (#18 Jun 1939 p.199) ¶3764 ACW/hite. *British Chess Magazine* (1937 vol.57 p.620, sol vol.58 1938 p.93) ¶4546. "Draw the following knight's tour. The problem - to find the knight! - A real chess picture puzzle." See Pictorial Tours for diagram. (1942 vol.62 p.168, sol p.218) ¶5819 HAA monogram. (1943 vol.63 p.216, sol p.261) ¶6147 PCT monogram. (1944 vol.64 p.24, sol p.70) ¶6280 QED monogram. (1945 vol.65 p.272, sol p.26) ¶6548 HAA tour repeated.

Temple, R. C. in *Indian Antiquary* 1923. Review of Naidu?

Tenac, Charles van: *Traités Illustrés des Jeux des Echecs* ... (48 pages, Passard, Paris 1869 or 1870, vol.1 p.34-39 [C].

Thee und Caffee Zeitvertreib 'Promenade des Springers' (2 Jan 1815). [M]

Thomas de Lavernède, J. E. see Lavernède.

Thon, Christian Friedrich Gottfried (1773-1844); *Thon's Meister im Schachspiel*... (Weimar 1863 p.194-5) edited by Max Lange [C]

Times Atlas of World History edited by Barraclough & Stone (1989, p.16) Plough.

Tolmatchoff, —: tours on small shaped boards, See *L'Echiquier* 1928-9.

Tomlinson, Charles (1808 Nov 27 London - 1897 Feb 15 Highgate London)

Saturday Magazine 1841 'The Knight's Tour'.

Amusements in Chess, John W. Parker, London 1845. [My own copy, now in BCPS Library.] The Preface notes that the book is based on articles that appeared in the *Saturday Magazine* 1841-44. Chapter 7 'The Knight`s Move' p.114-128 discusses tours of small boards, giving examples of size 5 (Euler), 6 and 7 (Willis) and then three of size 8 (Euler and two from Willis) though these sources are not mentioned. He then expounds Roget's method, but conflates it with the squares and diamonds. He gives de Moivre's tour as an example of rule, 'Play the knight to that square where he has the least power' and advocates the rule 'Keep as far from the centre as possible'. He gives an approximately biaxial tour with opposite numbers differing by 16. He concludes with a semi-magic tour, which is both of squares and diamonds type and Rogetian. He points out that a simple boustrophedonal numbering of the ranks also makes the files add to 260. A further tour, of Collini type, appears in Lesson 2 'The Moves' p.152–155. Tours from this work have been widely cited (Basterot 1853, Knight 1859, Staunton 1870 and Falkener 1892 who attributes the semi-magic tour to Roget).

Tope, Vinayaka Rajarama:*Buddhibalakrida* (Marathi) 1893. Ten tours. Six open tours 4×8 and four 8×8 tours: (1) Euler type open tour identical to Vyasa (1884) but rotated a half-turn. (2-3) Tomlinson/Roget tour, closed, and slightly modified version of same. (4) Closed tour formed of two of the six half-board tours linked asymmetrically. [Murray 1930]

Trigg, C. in *Journal of Recreational Mathematics* 1970 (?).

Troupenas, Eugéne-Théodore (1799-1850): 'Problème du Cavalier, Parcourant toutes les cases de l`echiquier', *Le Palamède* (1842 vol.2 Oct p.166-171, Nov p.221-226, Dec p.268-277, with six

line diagrams). Only the author's initials E. T. are given. The name Troupenas is revealed on his 10×10 tour diagram and in 1846 vol.6 p.418. Account of squares and diamonds.

Turkish A modern Turkish manuscript of chess problems "which may be as old as the middle of the 19th century" in the J. G. White Collection, Cleveland Library. Four tours: Knight-Alfil tour (like as-Suli c.900), plus 3×8, 4×8 and 8×8 open knight tours. [Murray 1930]

Twiss, Richard (1747 Apr 26 Rotterdam – 1821 Mar 5 Somers Town, London). *Chess* (two volumes 1787 and 1789). Vol.1 has three tours, Vol.2 two tours including one on a circular board.

Tychsen, C. *Tidskrift för Mathematik* (1865 ser.2 vol.1 p.17-20) [C]

Tylor, Christopher Max Bazett (1932 Aug 16 Dartmouth -) *Chessics* (#5 Jul 1978 p.7-8) Moose over Moose tour, Grasshopper over King tour. (#13 Jan 1982 p.11, sol #14 Jul 1982 p.12) Knight on '2-by-2 Torus' with 17 tours and analysis of symmetries.

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Unknown: (00i) is a magic knight tour whose composer and source is unknown, dated 1880/81.

Uri, Dario, *Journal of Recreational Mathematics* (vol 27 #3 1995 p.235-238) Solutions to Problems and Conjectures 2169 Maximum Angles in Knight's Tours.

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Valtorta, M. and **Zahid, M. I.**: *Journal of Recreational Mathematics* (vol.25 #4 1993 p.263-275) 'Warnsdorff's [sic] tours of a knight' (tries to show the weak property that a tour following Warnsdorf's rule is possible on all tourable boards) *Congr. Numer.* (#95 p.75-86) 'Tie-breaking rules for 4×n Warnsdorff's [sic] tours' [cited by Cairns 2002]

Vandermonde, Alexandre-Théophile (1735 Feb 28 Paris - 1796 Jan 1 Paris): 'Remarques sur les Problèmes de Situation' *L'Histoire de l'Academie des Sciences avec les Mémoires, Année 1771* [Paris 1774 vol.15 *Mémoires* p.566-574 and two plates]. Approximately symmetric tour 8×8 formed by linking four 16-move circuits in two stages. Also a 4×4×4 tour.

Vasa, Helge Emanuel de: [biographic details lacking] He was, in the 1950s, an invalid living in Paris. He exchangd extensive correspondence with T. H. Willcocks about magic knight tours. They applied Murray's extended quartes method to construct diagonally magic tours on boards of side 16, 24, 32, 48 and 64. This was reported in the issue of *Fairy Chess Review* following the obituary for Murray (vol.9 no.6 Oct 1955 p.46-47), though space prevented publication of diagrams. One 16×16 published in Willcocks (1962) and another in d'Hooghe (1962). Diagram of one quarter of 48×48 magic tour used on cover of *Chessics* #26 (1986).

Vasa also invented a form of chess on a lozenge-shaped honeycomb board. Some tours of the hexagonal board by the hexagonal equivalent of knights were given by him in late issues of *Fairy Chess Review* (¶9941, 1954 and ¶10056, 1955). These gave a knight tour of a 36-cell lozenge (and it was mentioned that the smallest board on which a tour is possible is the 25-cell), and knight tours on an 81-cell lozenge showing the square numbers on (a) the short and (b) the long diagonal, in order of magnitude. No more work on the subject of honeycomb board tours is known to me until my own work in Chessics #7 (1979).

Vasantha, Rangachar (died c. 2013) 'Deciphering the Board games invented by the Raja of Mysore'. Paper 13 in Part 3 'Mathematics and Artificial Intelligence' p.147-162 in *Step by Step. Proceedings of the 4th Colloquium Board Games in Academia*, ed. by Jean Reschetitzki and Rosita Haddad-Zubel (Editions Universitaires Fribourg, Suisse, 2002). Includes 11 puzzles, two not in Iyer 1982. Also *Maharaja's Games and Puzzles* (Foerder Schach-Geschichts forschung e. V, Kelkheim/Ts., Germany) Puzzles, p.45-60. Includes the 8×8 and 12×12 magic tours.

Vatriquant, Simon: (1892 Aug 6 - 1966 May 22) *L'Echiquier* 1928-9 assorted tours on small shaped boards with other composers: Godron, Marques, Post, Tolmatchoff. Aug 1928: a 36 cell tour, a

52-cell tour with oblique quaternary symmetry on a shaped board. Dec 1928: four 28 cell tours on a sort of 'tanned hide' shape. Jan 1929: assorted tours. May 1929: two 30-cell tours Eulerian and Bergholtian. Apr 1929: two tours of 44 cells. Also tours on cylinders (Sep 1929 p.414-415), Les parcours magiques de Lange in *Sphinx* 1933 [K]

Vencélidès, C.: see Wenzelides.

Vethake, J. (possibly John Vethake, 1905 Sep 14 - 1958 May 16). Versuch einer Lösung des Problems, um mittels 64 Zügen des Springers das Schachbrett zu füllen, und zwar in der Weise, dass Anfangs-und Endpunkt aneinanderschliessen. Gebrüder van der Hoek, Leiden 1933 [K4121]

Vinje, O. E. (of Baltimore): *Fairy Chess Review* (vol.4 #9 Dec 1940 p.119, sol #10 Feb 1941 p.130) ¶4656 Asks what leapers have the same angles between their moves as the knight. This is the first mention of angles between moves that I have noted. (vol.7 #7 Jun 1949 p.44, sol #8 Aug 1949 p.53) ¶8149 Enumeration of all shaped boards of 10 cells with closed knight tours.

Volpe, Lelio dalla (1685-1749) *Corsa del Cavallo per tutt`i schacchi dello Scacchiere* Bologna 1766 [K4064] [Cleveland Library confusingly catalogues it under the name of T. Ciccolini] [online] The first book to show tours in geometrical form. The foot of the title page reads 'In Bologna per Lelio dalla Volpe 1766'. This is the name of the publishing house and, possibly, the author. Lelio dalla Volpe founded the business and it was carried on by his son Petronio dalla Volpe (1721-1794). They became known for their clear printing. The heading on p.3 is: "Lo Stampatore a chi si diletta Del Giuoco de1 Scacchi" {The printer to those who delight in the game of chess}.

Volpicelli, Paolo (1804-1879) *Comptes Rendus de l'Académie des Sciences* (Paris vol.31 #10 p.314-322) 'Solution d'un Problème de Situation Relatif au Cavalier des Echecs' (séance du 2 Sep 1850) [A][C][K4077] Also (vol.74 #17 p.1099-1102) 'Solution Complète ...' (session of 22 Apr 1872) seconde note. And in Italian *Atti della Reale Academia de Lincei* (Rome vol.25 1872 p.87-160, 364-454; vol.26 1873 p.49-187, 241-325) 'Soluzione Completa e Generale, mediante la Geometria di Situazione, del Problema Relativo alle Corse del Cavallo sopra qualunque Scacchiere' (session 4 Feb 1872). The French version of this work was also issued in book form (389 pages). Pages 1-69 form a historical introduction. [K4087/88] The book was criticised in reviews by Tarry 1872 (q.v.), and in *City of London Chess Magazine* (vol.2 1875 #7 p.197) [Whyld]. He replied in *Les Mondes* (vol.33 1874 p.126-130) 'Réponse aux Critiques faites a ma Solution du Problème du Cavalier et des Echecs'. [A].

Much later, the book was scathingly reviewed for Murray by Bergholt (1916) saying 'There is not a scintilla of merit or interest (as regards the professedly original portion of this work:– Part II, p.70-389) ... Starting from any given cell, he proposes to tabulate every possible sequence of knight's moves, following out every path until it comes to an obligatory stop. This, he says, when completely carried out, will be a complete and general solution of the problem, free from all trial. ... The alleged 'solution', as will be seen at once, far from being free from all trial, is trial pure and simple. ... instead of seeking to abridge his trials (the true aim of all methods of solution of this and kindred problems), he takes a foolish pride in setting down every possible false step that can be taken.' It includes 48 tours 8×8 'all of a very commonplace and uninteresting type'.

Vyasa, Ambikadatta: *Chaturanga Chaturi* 1884. ['Vyasa' may just mean 'Compiler'] Twelve tours: (1) Euler's first open tour modified as a1 to h1. (2) Symmetric tour joining two half-board tours, similar to Euler. (3) Euler's 12-cell cross tour repeated four times in 8×8 board and joined up to make an open tour, omitting 16 cells in a pattern often seen on Indian boards. (4) Closed tour 7×8 in 3×8 and 4×8 compartments. (5) Open tour omitting 20 cells of 8×8, central 2×2 and 2×2 at middle of each edge. (6–7) Open and closed tours 5×8. (8) Symmetric tour 6×8 in two 3×8 compartments. (9-10) Near-symmetric open tours 4×8 and 3×8. (11–12) Open tours 6×6, one omitting four cells, b25e25. [Murray 1930]

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W—, (Le Chevalier) described as 'Capitaine au régiment de Kinski', wrote from Prague, 20 Apr 1773: 'Lettre.... sur un problème de l`échiquier' to the *Journal Encyclopédique* (vol.6 Aug 1773 p.123–125). Giving a closed asymmetric tour. This is much quoted in subsequent literature beginning with the 1790 edition of Ozanam's *Recreations*, where his regiment is described as 'dragons, au service de l'Impératrice-Reine'. History p.333.

Wadiar, Krishnaraj: see Mysore, Rajah of

Wahrscheinlichkeitsbetrachtungen uber den Rösselsprung See Biddle.

Walker, George (1803 Mar London - 1879 Apr 23):

A New Treatise on Chess 1832 Warnsdorf's rule (p.36 3rd edition 1841). See also Hone 1832.

Fraser's Magazine (Mar 1840 p.302-318) 'Chess without a Chessboard by a Chess Player'. Gives a mnemonic method (p.316-317) using lettered coordinates to give each square a monosyllabic name, allowing a tour to be memorised as a nonsense verse [cited by Roget 1840]. Authorship revealed in G. Walker *Phil. Mag.* Jun 1840. This reference recently became available via Google Books See Lettered Tours section.

London and Edinburgh Philosophial Magazine and Journal (ser.3 vol.16 Jan-Jun 1840) 'On Moving the Knight over Every Square of the Chessboard Alternately' (Jun p.498–501). "Those who have not gone deeply into chess are hardly aware that a whole library has been written upon the knight's move, and ten thousand modes are printed in which the feat may be performed." Warnsdorf's method. Bibliography of 11 titles. [C] [K4074] [Oxford Gen.Per.27]

Polytechnical Journal (1841 May p.243, Sep p.141).

Chess Player`s Chronicle; 1844, article on Rudrata.

The Boy's Own Conjuring Book (1860 Art.45 p.246–251) 'Moving the Knight over all the Squares Alternately' is after Walker. [Singmaster, 1991]

Warnsdorf, Heinrich Christian von (1780-1858): *Des Rösselsprunges einfachste und allgemeinste Lösung* {Knight's tours simple and general solution} Schmalkalden (68 pages, 16 plates with 96 figures). [A] [C] [K4069] [text but not figures now available in Google Books] Includes his famous Rule "Play the knight to a square where it commands the fewest cells not yet used". He begins by applying the rule to the 6×6 board and only gives one 8×8 example. His other main innovation is to show the first known tour fully of the squares and diamonds type.

Schachzeitung 'Zur Theorie des Rösselsprungs' (vol.13 Dec 1858 p.489-492). A short article in response to Slyvons (1856). [L] [A] [online]

Watkins, J. J. *Congressus Numerantum* #143 2000 'Knight's tours on cylinder and other surfaces.' (considers Mobius strips and Klein bottles) p.117-127. *Across the Board: The Mathematics of Chessboard Problems* Princeton University Press 2005. [cited by Kumar 2005, 2009]

Weber, A. *Monatsbericht der Königlichen Akademie der Wissenschaften zu Berlin* (Berlin 1873 p.705-735). Sanskrit text of Nilakant-ha, German translation [M]

Wegener, Ingo: See co-author Löbbing, M.

Welch, Lloyd R.: in S. W. Golomb, *Journal of Recreational Mathematics* 1968.

Wells, David: *The Penguin Book of Curious and Interesting Puzzles* (Penguin Books London 1992). Knight's tours mentioned p.37 (#132) with two symmetric 8×8 diagrams p.218. Smaller boards p.151 (#484) but states wrongly that "on a 4×4 board, wherever you start, either four or six squares will be omitted from your tour" (the minimum is 1 for an open tour, 2 for a closed tour). Smallest tourable rectangle is given p.339 as 3×7 instead of 3×4. Shows one of the five 6×6 tours with 90° rotational symmetry.

Welton, Jonathan: Unique tour on the 8×8 board with moves in only five directions [email to the author 20 Nov 2010]. See Graphic Tours.

Wenzelides, Carl or Vencélidès, Karl (1770 Sep Troppau, now Opava - 1852 May 6 Nikolsburg, now Mikulov). Murray (1951) describes Wenzelides as "a pensioned archivist of the Princes of Diedrichstein, who lived in Nicolsburg, Hungary. He was an invalid, confined for many years to his couch, who found a welcome relief to the tedium of his life in the composition of chess

problems and knight's tours. He has told the story of his research on the knight's problem in two most human and interesting articles in the *Schachzeitung*." His work is published in four articles investigating symmetric and magic tours. Donald Knuth wrote: "I found Karl Wenzelides 'polyhistorian' listed in *Biographisches Lexikon des Kaiserthums Österreich* by Wurzbach 1856-1891; this is almost certainly our man!" The dates above are from this source. "He wrote poetry and music, besides works on the Bronze Age, etc; many of his books and letters were in the Troppauer Museum." [Letter 24 May 1994]

Schachzeitung (vol.4 Feb-Mar 1849 p.41-93) 'Bemerkungen uber den Rösselsprung' (dated 1 Oct 1848). Wenzelides was the first after Brede (1844) to publish a substantial group of truly symmetric tours, i.e. unaltered by 180 degree rotation (26 in fact). He also mentions the possibility of forming letters in knight's moves, the beginnings of the Monogram Tours tradition. Fig.2, the only open tour, is similar to the Malabar tour of 1776 in having ends on the middle cells. Fig.5 shows approximate axial and Fig13 approximate biaxial symmetry. In some cases in his diagrams, as in Laisement, there are other pairs of moves that could be used to link the paths but usually with greater disruption to the overall pattern. Fig.15 and Fig.16 show approximate birotary symmetry (Fig 14 is the same as Laisement 1782). The final section of this article, Fig.55 onwards, is about half-board tours.

Schachzeitung (vol.4 Feb-Mar 1849 p.94-97) 'Der Rösselsprung in höchster Kunstvollendung' {The Knight's Tour in its Utmost Perfection}; This second article by Wenzelides, which follows on from the first, is accompanied by a poetic encomium signed Hn. [Wilhelm Hanstein (1811-1850), the editor]. The tour (12a) given in both geometrical and arithmetical forms, is the first closed magic knight tour to be discovered, and is also symmetric and of squares and diamonds type with the two diagonals adding to 520. It was constructed by Wenzelides on 19-20 Feb 1849.

Schachzeitung 'Bemerkungen uber den Rosselsprung' (1850 vol.5 p.212–221 §74-87 and p.230-240 §88-100 with figures 73-114 p.241-248. There are also Fig.115 and an unnumbered Fig of a semi-magic tour on p.240. [A] [M] [online] This is a continuation of the 1849 articles. It includes two new magic tours (12b) Fig.99 p.246 with explanation in §93 p.237, which differs from (12a) only by rotation of the four central links, and (27b) Fig.107 p.247, the first variant of the Beverley tour, though oriented to have 1 at top right. Much of the article is an explanation of the 'quartes' method under which name he includes squares, diamonds, Beverley and irregular four-move paths within a 4×4 area. Figs 73-84 show these quartes and combinations thereof. Fig 85 joins four 15-cell tours in an open tour, omitting one cell in each quarter (a4,a8,h4,h8). The other tours are experiments towards forming magic tours. The upper half of Fig.86 is Brede's semi-magic double half-board tour. Three of these are demimagic (all ranks and files adding to 258 or 262). Fig.95 has two zebra-move links and Fig.96 four rook-move links. Fig.93 and Fig.109 are identical to tours (11) and (7) in von Schinnern (1825), but with the numbering cycled by 16 steps in the latter case, so Wenzelides seems to have found these independently. Fig.100 is a pseudotour adding to 132 in all lines when suitably numbered. Fig 102 is an unnumbered symmetric tour (cc~). Confusingly, tours 114 and 115 in numerical form on p.240 correspond to the geometrical diagrams 113 and 114 on p.248.

Schachzeitung (vol.6 1851 p.286-297) 'Uber symmetrische Rösselsprünge' (19 paragraphs, no diagrams). This refers back to some Figures in the earlier 1849/50 articles. [A; M]

Schachzeitung 'Rösselsprung' (vol.13 May 1858 p.174–175). This article has three of the rediscovered tours (00m, 12e, 12m) and is signed 'v. Oppen' the new editor**.** These tours are on a separate page of four figures, lettered A to D and are shown graphically.

Weser Zeitung Bremen newspaper (1844-1934) 13 July 1924 has 10-line tour by M. Hogrefe.

Westminster Papers 1869 Jun 'The Tour of the Knight' p.18. According to the editor of the article by Gorgias (1871) this gives an account of Roget (1840). [L]

Weyl, Hermann*: Symmetry* (Princeton University Press 1952, reprint 1989). Mathematics and wider cultural significance of symmetry, but disappointing on terminology.

White, Alain Campbell (1880-1951) *Sam Loyd and his Chess Problems* (1913); *The Good Companions Chess Problem Club Folders* (1917 vol.4 Mar #.9 p.134-140). The first Euler tour is

quoted as having been used by the operator of the Kempelen automaton and reproduces a photo of a template for use in the machine showing this tour. Also reproduces photos of tours in the ms Abdul Hamid 1140 (= Baghdadi 1041) plus two tours by Euler and a magic tour, Wenzelides (12a). *Problemist Fairy Chess Supplement* (1933 vol.1 #17 Apr p.118) ¶753 a spoof 'mate in D' problem involving a 63-move Giraffe tour.

White, John Griswold (1845 - 1928); Bequeathed his Chess Collection to Cleveland Library, Ohio.

Whyld, Kenneth (1926 Mar 6 - 2003 Jul 11) See *Oxford Companion to Chess* 1984.

Wieber, Reinhard *Das Schachspiel in der arabischen Literatur von den Anfängen bis zur zweiten Hälfte des 16 Jahrhunderts*, Verlag für Orientkunde Dr H. Vorndran, Walldorf-Hessen. 1972 [cited by D. Singmaster 1987].

Wihnyk, Maxwell (of Frauenburg, Kurland) *Deutsche Schachzeitung* (1885 p.98, 289). Two articles on magic tours. The first giving a modification (27f) of Beverley's tour using irregular quartes in the right-hand half. This however was previously found by Reuss 1880 (this is a change from my 1986 catalogue). The second article showed how the braid in Beverley's tour could be extended to fill extra 4×4 areas to give a 16×16 magic tour (the first known example), and magic tours on all boards of $8n \times 8n$ with ($n > 1$) cells. The magic constant for the 16×16 board is 2056. See the large board tours section for diagram.

Willcocks, Theophilus Harding (1912 Apr 19 Newquay - 2014 Apr 14 Cambridge).

Fairy Chess Review (Aug 1944 p.101) ¶6096 54-move antelope (fiveleaper) path. (Dec 1955) The first published 12×12 magic tour with one diagonal magic (there is one in Murray 1942 ms).

Recreational Mathematics Magazine (Dec 1962 p.9-13) 'Magic Knight Tours on Square Boards' History and theory, plus new example 12×12 by THW with one diagonal magic. This article also includes a 16×16 diagonally magic tour by H. E. de Vasa.

Journal of Recreational Mathematics (vol.1 #4 p225-233, Oct 1968 p.225-233). 'The Construction of Magic Knight Tours'. Gives a table of known 8×8 tours identified by their diagonal sums. Gives another magic knight tour 12×12 with one diagonal magic, and diamagic tours 16×16 (the tour mentioned in *FCR*) and 20×20 (the first on this board).

Chessics (#2 July 1976 p.2) Conjecture: 'The smallest square board on which an {m,n} free leaper can make a closed tour is of side 2(m+n)'. (#6 Aug 1978 p.4-5) {3,4} and {2,5} tours 14×14. (#10 Dec 1980 p.5) {3,4} maximum length closed path on 8×8. (#23 Autumn 1985 p.84) 'Grasshopper over Knight Tours'. (#24 Winter 1985 p.93) Fiveleaper on centreless 7×7. (#25 Spring 1986 p.104) More on 'Grasshopper over Knight Tours'. (#26 Summer 1986 p.128) 'Magic Knight's Tours of Larger Boards' 12×12 tour with diagonals 870±74.

Games and Puzzles Journal (vol.1 #8+9 1988/9 p.143 and #11 1989 p.178) Rook around the rocks on larger boards. (vol.2 #13 May 1996 p.201) Research on biography of Ernest Bergholt.

Letter to G. P. Jelliss dated 17 June 1993 provided two examples of 12×12 bordered magic tours using other connection schemes than those described by Lange and Murray.

Willis, Robert (1800 Feb 27 London – 1875 Feb 28 Cambridge). He became Professor of Applied Mechanics at Cambridge 1837, but first made his mark in 1821 with: *An Attempt to Analyze the Automaton Chess Player of Mr DeKempelen. To which is added a copious collection of The Knight's Moves over the chessboard* (London 1821). The tours are on plates 6-10 which are scattered amongst unrelated text. [British Library, catalogued under Kempelen, shelfmark 1040.d.26(1).] No authors name is stated, but Tomlinson (1845) identifies Willis as the author of the section on the automaton.

Windisch, Karl Gottlieb von (1725 Jan 28 - 1793 Mar 30 Pressburg). Letter dated 18 Sep 1783, in a book by him published that year (and in an English translation of 1819) gives an eye-witness account of exhibitions of Kempelen's Automaton.

Winternitz, Moriz (1863-1937) *Geschichte der Indischen Literatur* (Leipzig 1905). [English translation *History of Indian Literature* 1985 includes revisions. An extract in Google Books, p.607 cites date for work of Nilakantha as 1640].

Wodeyar III, Krishnaraja see Mysore., Rajah of

Wolf, Rudolph (1816-1893) *Astronomische Mitteilungen* {Astronomy Information} §83 p.74-77 'Studie über den Rösselsprung' 1894. This knight's tour article is between passages about sun-spots! The tour shown is the one Euler sent to Goldbach 1757. [online]

Wolfram (pen name) The Listener Crossword 3353 in *The Times* Saturday 13 Apr 1996 (solution in *The Times* 4 May 1996) [Cutting from David Pritchard] This uses a 12×12 knight's tour.

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X à Belfort pen name of Professor Charles Emile Reuss.

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Yarbrough, L. D. *Journal of Recreational Mathematics* (vol.1 #3 Jul 1968 p.140-142) 'Uncrossed Knight's Tours'. This gives results on all rectangular boards up to 9×9, including the 7×7 tetraskelion design. Three 'Letters to the Editor' follow (vol.2 #3 Jul 1969 p.154-157) From R. E. Ruemmler, D. E. Knuth and M. Matsuda with further results.

Ylikarjula, Simo: *Chessics* (#14 1982 p.16) 'Progressive Leapers' (two 14-move paths).

Youth's Miscellany of Knowledge and Entertainment (Sherwood, Jones & Co publishers, London 1823 vol.1 p.261-283). [C] Not seen by me.

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Z

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Zahid, M. I. see co-author Valtorta, M.

Zuckermandel, Christoph Wilhelm (1767-1839) *Regeln nach denen alle Zauber-quadrate ... Anweisung den Rösselsprung* (Nürnberg 1838 p.62–88). This gives an account of the squares and diamonds method, with 112 tours in numerical form. (See ⌘ 6 p.18). There is then a batch of 31 closed tours that systematically show 1 in all positions in the triangle a8-d4-d8, wth 64 on or above the diagonal. Then a batch of 16 open tours (though #5 is reentrant) which start at a8 and end with 64 in a cell above the a8-h1 diagonal. A curious exercise shows 35 tours that omit one cell. The tours are still largely squares and diamonds. There is also a plate of line-drawn figures. [C] [Google Books, but the plate is folded with only one diagram visible.]

Zlata Praha 1895. A Prague newspaper, has a 10×10 open tour [Murray 1942]

Zürcher Illustrierte Zurich periodical 1925-1941. A number of tours on Shaped and Holey Boards collected by Murray (1942) showing unusual symmetries. 27 June 1930 A 52-cell tour with Murraian symmetry. 23 January 1931, 28 August 1931 and 27 May 1931 Two tours of shaped boards showing Sulian symmetry on boards of 34 and 66 cells, and a 10×10 tour with quaternary symmetry. 17 June 1932 a tour on the centreless 9×9 board. 15 July 1932 a 52 cell tour with four holes. 25 November 1932 a 92 cell tour with oblique quaternary symmetry. 7 July 1933 a shaped board tour with Sulian symmetry. 27 Oct 1933 oblique quaternary symmetry on a board of 64 cells. 8 June 1934 tour on shaped board of 38 cells showing Sulian symmetry. 13 July 1934 one of 50 cells in robot or skeleton shape.

Knight's Tour Notes

Acknowledgment

As the extensive bibliography indicates, with contributions to the subject being made every decade for the past 250 years, chessboard tours have possessed a continuing fascination for successive generations of chess problemists and mathematical puzzlers, though what the precise fascination is some may find difficult to ascertain! For my own part, it involves a mixture of the artistic attraction of pattern and intricacy, the mathematics of combinatorial enumeration and logical reasoning, and the recreational challenge of puzzle solving and creative construction. The topic offers a wide range of appeal across conventional subject boundaries.

A compilation such as this necessarily owes much to the labours of earlier scholars. My greatest debt is to the work of H. J. R. Murray. I am glad to have been able to fulfil a promise to his daughter the late Dr Katherine Maud Elisabeth Murray in 1991 to bring more of his unpublished material into view. There are still many sources that I have not been able to see for myself, where I have simply had to report the findings of others, and further work that ought to have been completed before publication, but further delay might mean its never appearing at all, so I hope such imperfections as result from this cause may be excused.

It is clear from recent work that application of computers to the problems of construction and enumeration is likely to lead to a considerable expansion of the subject in both depth and breadth, although to my mind it spoils much of the recreational fun to be found in it. Most of the work reported here has been achieved by simple means of pen and paper and careful reasoning. I hope readers will be encouraged to try to make their own contributions to the subject. One aim of this compilation is to provide a clear account of most of the work that has been done hitherto, so that future workers can avoid merely duplicating past results.

Outline of the Series

These PDF monographs summarise the material accummulated on the ***Knight's Tour Notes*** webpages which are part of the ***Mayhematics*** website that I began in the year 2000.

We begin in ⌘ 1 with notes on theory of moves and journeys by pieces of all types on all kinds of board, set out from first principles, aiming at mathematical clarity. This includes a discussion of symmetry and magic properties, which are recurring topics throughout. Historical notes accompany topics as they arise, so are not necessarily in unbroken chronological order. This concludes with an account of knight tours on the smallest boards (up to 12 cells).

There follow in ⌘ 2 notes on tours by pieces with lateral moves, the Wazir {0,1} and Rook {0,n}, and those that also make diagonal moves, the King {0,1}+{1,1} and Queen. With an appendix on Rider and Hopper crossover tours.

We then turn to the geometry associated with the Knight's {1,2} move, which is the subject of the main text. In ⌘ 3 we look at knight tours on shaped boards in ⌘ 4 on oblong boards and in ⌘ 5 on squares of odd sides 5×5, 7×7, ... and oddly-even sides, 6×6, 10×10, ... The smallest boards allow complete enumeration of their tours. On larger boards we can show only examples.

As might be expected the bulk of the text is devoted to knight tours on the standard 8×8 chessboard. This begins in ⌘ 6 with a history of early developments, including squares and diamonds and Roget's nets. and then looks at graphic effects of lines, angles and shapes within tours, including pictorial and monogram tours, and the methods of forming tours from crosspatch pseudotours. This is followed in ⌘ 7 by a systematic study on asymmetry and symmetry on the 8×8 board, leading to a thorough treatment of mixed quaternary symmetry. Some work on the 12×12 and 16×16 boards is included. Then in ⌘ 8 we turn to cataloguing octonary and quaternary pseudotours, with some tours derived from them.

The historical approach resumes in ⌘ 9 with a study of magic knight tours and their enumeration, which began in 1848 and was completed only in 2003. This concludes with catalogues of all 108 geometrical and all 280 arithmetical magic tours on the 8×8 board. Further notes cover magic tours on other evenly-even boards of sizes 12×12, 16×16 and larger.

After the Knight we look in ⌘ 10 first at Augmented Knights that combine knight-line moves with lateral and diagonal moves, such as in the Emperor {0,1}+{1,2} and Empress (Rook+Knight) family. This leads to increasingly complex pieces with three, four or more move-powers. Then we meet longer generalised knights (Beasts as I call them): Camel {1,3}, Zebra {2,3}, Giraffe {1,4}, Antelope {3,4} and so on, and their combinations with simpler pieces and with other Beasts. This subject merges with the traditional field of magic squares.

In ⌘ 11 we peer briefly into various Alternative Worlds that take us away from the main lines of our subject. Lettered and Figured Tours. Non-crossing Leaper tours. Alternative Boards of curved, spatial and honeycomb forms.

We conclude in ⌘ 12 with a chronology and bibliography in which notes are provided on the contents of the books and articles listed, particularly where they contain original results, together with library references to assist future research. Biographical notes on authors are also included where known or thought relevant.

The Volumes in the Series

⌘ 1. Theory of Moves
(Including theory of symmetry and magic and knight-move geometry)
⌘ 2. Walker Tours
(About lateral and diagonal movers Wazir, Rook, King, Queen)
⌘ 3. Shaped & Holey Boards
(A collection of knight tours exploring varieties of symmetry)
⌘ 4. Oblong Boards
(Including history of 4×8 knight tours and new results on magic rectangles)
⌘ 5. Odd and Oddly Even Boards
(With large sections on 6×6 and 10×10 knight tours)
⌘ 6. Geometry of Chessboard Knight Tours
(History of 8×8 tours, with study of crosspatch patterns and enumeration).
⌘ 7. Symmetry in Chessboard Knight Tours
(Approximate, exact and mixed symmetry, on evenly even boards)
⌘ 8. Octonary & Quaternary Pseudotours
(Catalogued with some tours derived from them)
⌘ 9. Magic Knight Tours
(With a complete catalogue of 8×8 and examples on larger boards)
⌘ 10. Augmented Knight & Leaper Tours
(Tours by compound movers and longer leapers).
⌘ 11. Alternative Worlds
(Figured, Lettered Tours, Bent Boards, Space Chess, Honeycombs)
⌘ 12. Chronology & Bibliography of Tours
(With acknowledgmants and outline of the series)