The Stellar Command Module

for

Integrating Astronomy and Art

User Guide

Angelo Fraietta

University of New South Wales

First edition: 6 June 2019

Short contents

Contents

List of Figures

List of Tables

List of typeset examples

Preface

From personal experience and also from lurking on the comp.text.tex newsgroup the major problems with using LaTeX are related to document design. Some years ago most questions on CTT were answered by someone providing a piece of code that solved a particular problem, and again and again. More recently these questions are answered along the lines of 'Use the ——— package', and again and again.

I have used many of the more common of these packages but my filing system is not always well ordered and I tend to mislay the various user manuals, even for the packages I have written. The memoir class is an attempt to integrate some of the more design-related packages with the LaTeX book class. I chose the book class as the report class is virtually identical to book, except that book does not have an `abstract` environment while report does; however it is easy to fake an `abstract` if it is needed. With a little bit of tweaking, book class documents can be made to look just like article class documents, and the memoir class is designed with tweaking very much in mind.

The memoir class effectively incorporates the facilties that are usually accessed by using external packages. In most cases the class code is new code reimplementing package functionalities. The exceptions tend to be where I have cut and pasted code from some of my packages. I could not have written the memoir class without the excellent work presented by the implementors of LaTeX and its many packages.

Apart from packages that I happen to have written I have gained many ideas from the other packages listed in the Bibliography. One way or another their authors have all contributed, albeit unknowingly. The participants in the comp.text.tex newsgroup have also provided valuable input, partly by questioning how to do something in LaTeX, and partly by providing answers. It is a friendly and educational forum.

PETER WILSON
Seattle, WA
June 2001

Introduction

Terminology

Like all professions and trades, typographers and printers have their specialised vocabulary.

Units of measurement

Typographers and printers use a mixed system of units, some of which we met above. The fundamental unit is the point; Table **??** lists the most common units employed.

One

Starting off

1.1 Launching Stellar Command as a Standalone Process

The Stellar Command module is instantiated by executing Java with the name of the JAR file and the required program arguments that define communication, such as the network port to send OSC messages to, and the OSC address space. For example, to start the StellarCommand module so it sends OSC messages on UDP port 1234 using an OSC address space of `/Stellar`,[1] one would execute the following command:

```
java -jar StellarCommand.jar port=1234 osc=/Stellar
```

When the server starts, it will open the first available UDP port, and notify the client of this port. For example, if the command module opened port 4567, it will send an OSC message `/Stellar/osc 4567` to the client on the localhost.

```
/Stellar/osc 4567
```

Allowing the command module to find its own port number removes the probability of port clashes as each client furnishes the other with a valid port number for communicating without requiring configuration in the command module. It is, however, possible to request the Stellar Command module try certain ports by adding the argument *tryport* with a comma separated list of ports. For example, the argument `tryport=3333,4444,5555` will cause Stellarium to sequentially try opening the ports listed, and if these all fail, will then open the first available port.

```
java -jar StellarCommand.jar port=1234 osc=/Stellar tryport=3333,4444,5555
```

The OSC client would receive the following OSC message:

[1] In this instance, the OSC client and Stellarium are on the same computer.

/Stellar/osc 3333

The OSC client and the Stellarium server do not have to be on the same physical computer as the Stellar Command module. For example Figure 1.1, shows three OSC clients and a Stellarium server on a LAN, and a remote Stellarium server accessible from the internet through *myserver.com*.

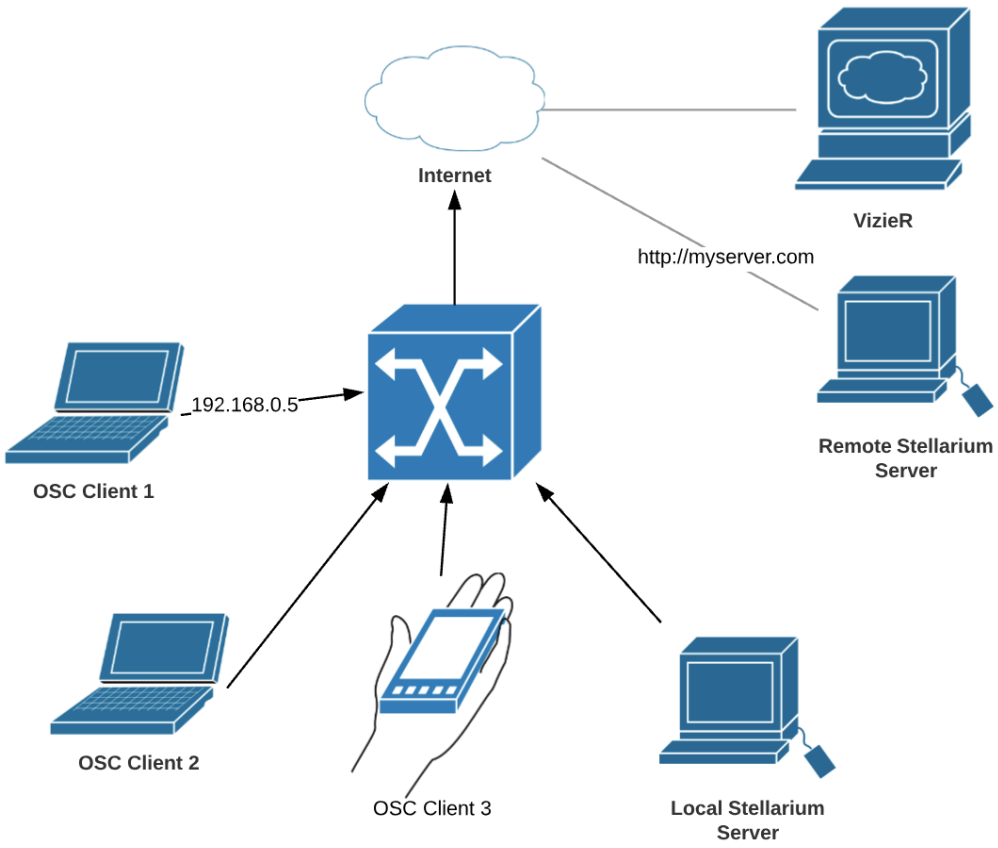

Figure 1.1: Remote Stellarium and OSC Clients.

Creating a connection between *OSC Client 1* and `Remote Stellarium Server` is effected by adding adding the arguments
`client=192.168.0.5` and `stellarium=http://myserver.com` to the command line. This will cause the Stellar Command module to send OSC messages to "192.168.0.5" and Stellarium commands to *http://myserver.com* on HTP port 8090[2], effectively acting as a

[2]The default Stellarium Remote Control port is 8090, however, this can be changed inside Stellarium. It is

proxy between the two.

```
java -jar StellarCommand.jar port=1234 osc=/Stellar \
client=192.168.0.5 stellarium=http://myserver.com
```

assumed that port forwarding when not using a local area network has been configured to send packages to the correct computer hosting Stellarium

Two

Laying out the page

Three

Comments

3.1 ALGORITHMS

Over time we may use this section to explain, or list some of the algorithms for some of the macros in the class. The information may be useful to some.

3.1.1 Autoadjusting `\marginparwidth`

This algorithm is used within `\fixthelayout` unless the user have used `\setmarginnotes`.

```
if twocolumn then
  marginparwidth = min{inner margin,outer margin}
else
  if twoside then
    if marginpar always left or always right then
      marginparwidth = min{inner margin,outer margin}
    else if marginpar in outer margin then
      marginparwidth = outer margin
    else if marginpar in inner margin then
      marginparmargin = inner margin
    end if
  else
    if marginpar in left margin then
      marginparwidth = inner margin
    else
      marginparwidth = outer margin
    end if
  end if
end if
marginparwidth = marginparwidth - 2marginparsep
if marginparwidth < 1pt then
  marginparwidth = 1pt
end if
```

Notes

Bibliography

CTAN is the Comprehensive TeX Archive Network. Information on how to access CTAN is available at http://www.tug.org.

[20117] 2017.

[20118] 2018.

[AAU] Astronomy archives user group (aaug.

[ABB16] Samuel Aaron, Alan F Blackwell, and Pamela Burnard. The development of Sonic Pi and its use in educational partnerships: Co-creating pedagogies for learning computer programming. *Journal of Music, Technology & Education*, 9(1):75–94, 2016.

[AF02] Gerard Assayag and Hans G Feichtinger. *Mathematics and music: A Diderot mathematical forum*. Springer Science & Business Media, 2002.

[Ano19] Anonymous. Reference suppressed for anonymity during peer review. 2019.

[AOB14] Samuel Aaron, Dominic Orchard, and Alan F Blackwell. Temporal semantics for a live coding language. In *Proceedings of the 2nd ACM SIGPLAN international workshop on Functional art, music, modeling & design*, pages 37–47. ACM, 2014.

[Ash15] Joseph Ashley. Computers and computer programs. In *Astrophotography on the Go*, pages 151–161. Springer, 2015.

[Azu01] L. Azura. Design of an audio player as system-on-a-chip. *Master's Thesis, Institute of Computer Science, University of Stuttgart*, 2001.

[Bad14] Yusuf Abdullahi Badamasi. The working principle of an Arduino. pages 1–4. IEEE, September 2014.

[Bar16] Steven F. (Steven Frank) Barrett. *Bad to the Bone : crafting electronic systems with BeagleBone Black*. Synthesis digital library of engineering and computer science. Second edition. edition, 2016.

[Ber01] Arnold S Berger. *Embedded systems design: an introduction to processes, tools, and techniques*. CRC Press, 2001.

[Ber08] K Berglund. Using free, open source Stellarium software for iya2009. In *Preparing for the 2009 International Year of Astronomy: A Hands-On Symposium*, volume 400, page 483, 2008.

[BF16] Oliver Bown and Sam Ferguson. A musical game of bowls using the diads. In *Proceedings of the International Conference on New Interfaces for Musical Expression*, pages 371–372, 2016.

[BF17] Oliver Bown and Sam Ferguson. Creative media+ the internet of things= media multiplicities. *Leonardo*, (Early Access):53–54, 2017.

[BF18] Oliver Bown and Sam Ferguson. Understanding media multiplicities. *Entertainment Computing*, 25:62–70, 2018.

[BFF+19] O. Bown, A. Fraietta, S. Ferguson, L Loke, and L. Bray. Strategies to facilitate rapid creative development with multiple networked devices using HappyBrackets. In *International Conference on New Interfaces for Musical Expression (NIME-2019)*. Federal University of Rio Grande do Sul, 2019.

[Bin10] A. Binstock. Infoworld review: Top Java programming tools. https://www.infoworld.com/article/2683534/development-environments/infoworld-review--top-java-programming-tools.html, 2010. Accessed: 2018-07-05.

[BL15] Ilias Bergstrom and R Beau Lotto. Code bending: A new creative coding practice. *Leonardo*, 48(1):25–31, 2015.

[BLFR15] Oliver Bown, Lian Loke, Sam Ferguson, and Dagmar Reinhardt. Distributed interactive audio devices: Creative strategies and audience responses to novel musical interaction scenarios. In *International Symposium on Electronic Art*. ISEA, 2015.

[Bri86] Reginald Smith Brindle. *Musical composition*. Oxford University Press, 1986.

[Bri13] Colin Bright. spa-c–e, 2013. Performed live at Colbourne Ave Glebe, Sydney, Australia May 23rd 2013 by The Colin Bright Syzygy Band and Angelo Fraietta.

[Buk14] Ivica Ico Bukvic. Pd-l2ork Raspberry Pi toolkit as a comprehensive Arduino alternative in k-12 and production scenarios. In *NIME*, pages 163–166, 2014.

[BWG+06] Michael Barnett, Heather Wagner, Anne Gatling, Janice Anderson, Meredith Houle, and Alan Kafka. The impact of science fiction film on student understanding of science. *Journal of Science Education and Technology*, 15(2):179–191, 2006.

[BYJ13] Oliver Bown, Miriama Young, and Samuel Johnson. A Java-based remote live coding system for controlling multiple Raspberry Pi units. In *ICMC*, 2013.

[C+03] PC/104 Embedded Consortium et al. Pc/104 specification version 2.5. *San Francisco: PC/104 Embedded Consortium*, 2003.

[Cag07] Nergiz Ercil Cagiltay. Teaching software engineering by means of computer-game development: Challenges and opportunities. *British Journal of Educational Technology*, 38(3):405–415, 2007.

[Cam54] William Bruce Cameron. Sociological notes on the jam session. *Social forces*, pages 177–182, 1954.

[CMWW11] Jitong Chen, Lingquan Meng, Xiaonan Wang, and Chenhui Wang. An integrated system for astronomical telescope based on Stellarium. In *Advanced Computer Control (ICACC), 2011 3rd International Conference on*, pages 431–434. IEEE, 2011.

[Coi00] Raimundo Olavo Coimbra. *A bandeira do Brasil: raízes histórico-culturais*. Instituto Brasileiro de Geografia e Estatística-IBGE, 2000.

[dBAB+00] Pea de Bernardis, Peter AR Ade, JJ Bock, JR Bond, J Borrill, A Boscaleri, K Coble, BP Crill, G De Gasperis, PC Farese, et al. A flat universe from high-resolution maps of the cosmic microwave background radiation. *Nature*, 404(6781):955, 2000.

[DC90] Stephen E. Deering and David R. Cheriton. Multicast routing in datagram internetworks and extended lans. *ACM Trans. Comput. Syst.*, 8(2):85–110, May 1990. Accessed: 2018-07-05.

[Dea09] Roger T Dean. *The Oxford handbook of computer music*. OUP USA, 2009.

[DeB00] George E DeBoer. Scientific literacy: Another look at its historical and contemporary meanings and its relationship to science education reform. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, 37(6):582–601, 2000.

[DJ00] GUSTAVO Diaz-Jerez. Algorithmic music: using mathematical models in music composition. *The Manhattan School of Music*, 2000.

[dM15] Flávia Cristina de Mello. *Astronomy and Cosmology of the Guarani of Southern Brazil*, pages 975–980. Springer New York, New York, NY, 2015.

[DM18] Roger T Dean and Alex McLean. *The Oxford Handbook of Algorithmic Music*. Oxford University Press, 2018.

[DSC05] Anderson Faustino Da Silva and Vitor Santos Costa. An experimental evaluation of Java JIT technology. *J. UCS*, 11(7):1291–1309, 2005.

[DSZ11] Peter Duffett-Smith and Jonathan Zwart. Practical astronomy with your calculator or spreadsheet. *Cambridge University Press,*, 2011.

[Dua10] Paulo Araújo Duarte. Astronomia na Bandeira Brasileira. https://web.archive.org/web/20080502120005/http://www.cfh.ufsc.br/~planetar/textos/astroban.htm, 2010. Accessed: 2018-12-21.

[Dyk11] Gregory Dyke. Which aspects of novice programmers' usage of an ide predict learning outcomes. In *Proceedings of the 42nd ACM technical symposium on Computer science education*, pages 505–510. ACM, 2011.

[End99] Mica R Endsley. Level of automation effects on performance, situation awareness and workload in a dynamic control task. *Ergonomics*, 42(3):462–492, 1999.

[Far15] Eleanor Farrington. Parametric equations at the circus: Trochoids and poi flowers. *The College Mathematics Journal*, 46(3):173–177, 2015.

[FB17] Sam Ferguson and Oliver Bown. Creative coding for the Raspberry Pi using the HappyBrackets platform. In *Proceedings of the 2017 ACM SIGCHI Conference on Creativity and Cognition*, pages 551–553. ACM, 2017.

[FB19] Angelo Fraietta and Oliver Bown. Creating a sonified spacecraft game using HappyBrackets and Stellarium. In *Procedings of the 17th Linux Audio Conference (LAC-19)*, pages 1–7. CCRMA, Stanford University, USA, 2019.

[FdSNdSO19] A Fraietta, Helena de Souza Nunes, and Natanael de Souza Ourives. Creating order and progress. In *International Conference on New Interfaces for Musical Expression (NIME-2019)*. Federal University of Rio Grande do Sul, 2019.

[FM11] Emmanuel Fléty and Côme Maestracci. Latency improvement in sensor wireless transmission using IEEE 802.15. 4. In *New Interfaces for Musical Expression (NIME 2011)*, pages 409–412, 2011.

[Fra05a] Angelo Fraietta. The smart controller workbench. In *Proceedings of the 2005 conference on New interfaces for musical expression*, pages 46–49. University of British Columbia, Vancouver, 2005.

[Fra05b] Angelo Fraietta. Smart controller/bell garden demo. In *Proceedings of the 2005 conference on New interfaces for musical expression*, pages 260–261. National University of Singapore, 2005.

[Fra06] Angelo Fraietta. *The Smart Controller – an integrated electronic instrument for real-time performance using programmable logic control*. Phd, Western Sydney University, 2006.

[Fra08a] Angelo Fraietta. Open Sound Control: Constraints and limitations. In *International Conference on New Interfaces for Musical Expression (NIME-2008)*, pages 19–23, 2008.

[Fra08b] A Fraknoi. Music inspired by astronomy: A selected listing for the international year of astronomy. In *Preparing for the 2009 International Year of Astronomy: A Hands-On Symposium*, volume 400, page 514, 2008.

[Fra14a] Angelo Fraietta. Echoes from the fourth day - a segue through the southern night sky for FM synthesiser and binoculars, 2014. Performed in Brickworks Park in collaboration with the Newcastle Astronomical Society.

[Fra14b] Angelo Fraietta. Musical composition with naked eye and binocular astronomy. In *Australasian Computer Music Conference 2014*, pages 47–52. Victorian College of the Arts, 2014.

[Fra19a] A Fraietta. Stellar command: a planetarium based cosmic performance interface. In *International Conference on New Interfaces for Musical Expression (NIME-2019)*. Federal University of Rio Grande do Sul, 2019.

[Fra19b] A. Fraietta. Stellar command software module. https://github.com/angelofraietta/StellarCommand, 2019. Accessed: 2019-02-02.

[FRB+17] Sam Ferguson, Anthony Rowe, Oliver Bown, Liam Birtles, and Chris Bennewith. Networked pixels: Strategies for building visual and auditory images with distributed independent devices. In *Proceedings of the 2017 ACM SIGCHI Conference on Creativity and Cognition*, pages 299–308. ACM, 2017.

[FW09] A. J. Figueredo and P. S. A. Wolf. Assortative pairing and life history strategy - a cross-cultural study. *Human Nature*, 20:317–330, 2009.

[Gam93] Olympic Games. Music of the spheres. 1993.

[GBL94] Patricia M Greenfield, Craig Brannon, and David Lohr. Two-dimensional representation of movement through three-dimensional space: The role of video game expertise. *Journal of applied developmental psychology*, 15(1):87–103, 1994.

[Gep18] Alexander CT Geppert. *Imagining outer space: European astroculture in the twentieth century*. Springer, 2018.

[Ger05] Lincoln Geraghty. Creating and comparing myth in twentieth-century science fiction:“star trek" and “star wars". *Literature/Film Quarterly*, 33(3):191–200, 2005.

[Gre10] Bruce Gregory. The integration of classical music composition theory with mind-body hypnotherapy. *Australian Journal of Clinical and Experimental Hypnosis (Online)*, 38(1):1, 2010.

[HA07] Jean-Michel Hoc and René Amalberti. Cognitive control dynamics for reaching a satisficing performance in complex dynamic situations. *Journal of cognitive engineering and decision making*, 1(1):22–55, 2007.

[HC02] Cay S Horstmann and Gary Cornell. *Core Java 2: Volume I, Fundamentals*. Pearson Education, 2002.

[HC15] Joan Horvath and Rich Cameron. Cosplay, wearable tech, and the internet of things. In *The New Shop Class*, pages 85–96. Springer, 2015.

[Hey03] Paul Heyer. America under attack i: a reassessment of orson welles' 1938 war of the worlds broadcast. *Canadian Journal of Communication*, 28(2):149, 2003.

[Hin16] Abram Hindle. Hacking nimes. In *Proceedings of the International Conference on New Interfaces for Musical Expression*, volume 16 of *2220-4806*, pages 359–364, Brisbane, Australia, 2016. Queensland Conservatorium Griffith University.

[Hub12] David Miles Huber. *The MIDI manual: a practical guide to MIDI in the project studio*. Focal Press, 2012.

[Hur58] Paul D Hurd. Science literacy: Its meaning for american schools. *Educational leadership*, 16(1):13–16, 1958.

[Hym07] Mark Hyman. The first mind-body medicine: Bringing shamanism into the 21st century. *Alternative therapies in health and medicine*, 13(5):10–11, 2007.

[Idr14] Ivan Idris. *Python data analysis*. Packt Publishing Ltd, 2014.

[Ing17] Simon Ings. Plane speaking: Analogue tech powers a futuristic artwork. *New Scientist Archive*, 235(3133):43, 2017.

[Jam95] Jamie James. *The music of the spheres: Music, science, and the natural order of the universe*. Springer Science & Business Media, 1995.

[K.86] Martin K. Parsing in functional unification grammar. In K. Spark Jones B. J. Grosz and B. L. Webber, editors, *Readings in Natural Language Processing*, pages 125–138. Morgan Kaufmann Publishers, Los Altos, 1986.

[KBB+10] David G Koch, William J Borucki, Gibor Basri, Natalie M Batalha, Timothy M Brown, Douglas Caldwell, Jørgen Christensen-Dalsgaard, William D Cochran, Edna DeVore, Edward W Dunham, et al. Kepler mission design, realized photometric performance, and early science. *The Astrophysical Journal Letters*, 713(2):L79, 2010.

[KCC+07] Amit Kapadia, Fabien Chéreau, Lars Lindberg Christensen, Lars Holm Nielsen, Adrienne Gauthier, Robert Hurt, and Ryan Wyatt. Vamp in Stellarium/virgo: A proof of concept. *Proceedings from Communicating Astronomy with the Public*, 2007.

[KG07] Yasmin B Kafai and Michael T Giang. Virtual playgrounds: Children's multi-user virtual environments for playing and learning with science. *Children's learning in a digital world*, pages 196–217, 2007.

[KJ] Petr Kubánek and Martin Jelínek. Rts2–open source observatory manager.

[KK02] James Keogh and Jim Keogh. *J2EE: The complete reference*. McGraw-Hill/Osborne, 2002.

[KK06] Zoltán Kolláth and Jen O Keuler. Stellar acoustics as input for music composition. *Musicae Scientiae*, 10(1_suppl):161–183, 2006.

[KLPL16] Hee-Won Kim, Su-Jung Lee, Han-Ju Park, and Suk-Ho Lee. Ambient lighting for korean karaoke based on screen colors and singer interaction. *Indian Journal of Science and Technology*, 9(46), 2016.

[Kno76] Francis Knobloch. The Tukano indians and advancing “civilisation". *Mankind Quarterly*, 17(2), 1976.

[Lar02] Craig Larman. *Applying UML and patterns: an introduction to object-oriented analysis and design and the unified process*. Prentice Hall, second edition, 2002.

[LBF+18] L. Loke, O Bown, S Ferguson, L Bray, A Fraietta, and K Packham. Your move sounds so predictable! In *Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play (CHI PLAY 2018) Companion Extended Abstracts*, pages 121–125. ACM, 2018.

[LE14] Sang Won Lee and Georg Essl. Models and opportunities for networked live coding. 2014.

[Led02] Jim Ledin. Simulation takes off with hardware. *Embedded Systems Programming*, 15(4):19–29, April 2002.

[Lia99] Sheng Liang. *The Java Native Interface: Programmer's Guide and Specification*. Addison-Wesley Professional, 1999.

[Lim15] Flávia Pedroza Lima. *Astronomy in Brazilian Ethnohistory*, pages 945–951. Springer New York, New York, NY, 2015.

[LK06] Jim Lovell and Jeffrey Kluger. *Apollo 13*. Houghton Mifflin Harcourt, 2006.

[LML+10] Miranda Lundy, John Martineau, Miranda Lundy, Daud Sutton, Anthony Ashton, and Jason Martineau. *Quadrivium: The four classical liberal arts of number, geometry, music, & cosmology*. Walker & Company, 2010.

[LYBB14] Tim Lindholm, Frank Yellin, Gilad Bracha, and Alex Buckley. *The Java virtual machine specification*. Pearson Education, 2014.

[LZ12] Yuxi Liu and Guohui Zhou. Key technologies and applications of internet of things. pages 197–200. IEEE, January 2012.

[Mag11] Thor Magnusson. Algorithms as scores: Coding live music. *Leonardo Music Journal*, pages 19–23, 2011.

[Mag14] Thor Magnusson. Scoring with code: Composing with algorithmic notation. *Organised Sound*, 19(3):268–275, 2014.

[Mah05] Michael S Mahoney. The histories of computing (s). *Interdisciplinary Science Reviews*, 30(2):119–135, 2005.

[Mal82] Thomas W Malone. Heuristics for designing enjoyable user interfaces: Lessons from computer games. In *Proceedings of the 1982 conference on Human factors in computing systems*, pages 63–68. ACM, 1982.

[Mar11] Michael Margolis. *Arduino Cookbook: Recipes to Begin, Expand, and Enhance Your Projects*. "O'Reilly Media, Inc.", 2011.

[MBJ+16] Giulio Moro, Astrid Bin, Robert H Jack, Christian Heinrichs, Andrew P son, et al. Making high-performance embedded instruments with bela and pure data. 2016.

[MC09] Matthew Mc Cool. Touring the cosmos through your computer: a guide to free desktop planetarium software. *CAPjournal,(7)*, pages 21–23, 2009.

[McC18] Mark McCurry. Rtosc-realtime safe open sound control messaging. In *Linux Audio Conference 2018*, page 51, 2018.

[Mir01] Eduardo Miranda. *Composing music with computers*. Focal Press, 2001.

[MJM+16] Andrew P McPherson, Robert H Jack, Giulio Moro, et al. Action-sound latency: Are our tools fast enough? 2016.

[MKC12] Jim Murphy, Ajay Kapur, and Dale Carnegie. Musical robotics in a loudspeaker world: Developments in alternative approaches to localization and spatialization. *Leonardo Music Journal*, pages 41–48, 2012.

[MLF+02] Dieter Mehrholz, L Leushacke, W Flury, R Jehn, H Klinkrad, and M Landgraf. Detecting, tracking and imaging space debris. *ESA Bulletin(0376-4265)*, (109):128–134, 2002.

[MML18] Hicham Medromi, Laila Moussaid, and FAL Laila. Analysis of the allocation of classes, threads and cpu used in embedded systems for Java applications. *Procedia computer science*, 134:334–339, 2018.

[Mon16] Simon Monk. *Raspberry Pi cookbook: Software and hardware problems and solutions*. "O'Reilly Media, Inc.", 2016.

[Mor96] Henry M Morris. Meeting user needs keeps board business booming. *Control Engineering*, 43(11):D, 1996.

[MQW10] Steve Massey, Steve Quirk, and Fred Watson. *Atlas of the Southern Night Sky*. New Holland Publishers, 2010.

[MR02] Iain Milne and Glenn Rowe. Difficulties in learning and teaching programming—views of students and tutors. *Education and Information technologies*, 7(1):55–66, 2002.

[MW64] F. Mosteller and D. Wallace. *Inference and Disputed Authorship: The Federalist*. Addison-Wesley, Reading, Massachusetts, 1964.

[MW09] Alex McLean and Geraint A Wiggins. Words, movement and timbre. In *NIME*, pages 276–279. Citeseer, 2009.

[MZ15] Andrew McPherson and Victor Zappi. An environment for submillisecond-latency audio and sensor processing on beaglebone black. In *Audio Engineering Society Convention 138*. Audio Engineering Society, 2015.

[OBM00] François Ochsenbein, Patricia Bauer, and James Marcout. The VizieR database of astronomical catalogues. *Astronomy and Astrophysics Supplement Series*, 143(1):23–32, 2000.

[Och10] François Ochsenbein. The "vizquery" program. http://vizier.u-strasbg.fr/vizier/doc/vizquery.htx, 2010. Accessed: 2019-01-18.

[Oui10] Hector Ouilhet. Google sky map: using your phone as an interface. In *Proceedings of the 12th international conference on Human computer interaction with mobile devices and services*, pages 419–422. ACM, 2010.

[Pac96] Jozef Pacholczyk. Music and astronomy in the muslim world. *Leonardo*, 29(2):145–150, 1996.

[Qua02] Terry Quatrani. *Visual modeling with rational rose 2002 and UML*. Addison-Wesley Longman Publishing Co., Inc., 2002.

[R+15] Clive LN Ruggles et al. *Handbook of Archaeoastronomy and Ethnoastronomy*. Springer New York, 2015.

[RCL99] Bryan L Riemann, Nancy A Caggiano, and Scott M Lephart. Examination of a clinical method of assessing postural control during a functional performance task. *Journal of Sport Rehabilitation*, 8(3):171–183, 1999.

[RD76] Gerardo Reichel-Dolmatoff. Cosmology as ecological analysis: a view from the rain forest. *Man*, pages 307–318, 1976.

[RML+06] Jukka Rönkkö, Jussi Markkanen, Raimo Launonen, Marinella Ferrino, Enrico Gaia, Valter Basso, Harshada Patel, Mirabelle D'Cruz, and Seppo Laukkanen. Multimodal astronaut virtual training prototype. *International Journal of Human-Computer Studies*, 64(3):182–191, 2006.

[RNC+03] Ricardo Rosas, Miguel Nussbaum, Patricio Cumsille, Vladimir Marianov, Mónica Correa, Patricia Flores, Valeska Grau, Francisca Lagos, Ximena López, Verónica López, et al. Beyond nintendo: design and assessment of educational video games for first and second grade students. *Computers & Education*, 40(1):71–94, 2003.

[RPK+15] Karen Robson, Kirk Plangger, Jan H Kietzmann, Ian McCarthy, and Leyland Pitt. Is it all a game? Understanding the principles of gamification. *Business Horizons*, 58(4):411–420, 2015.

[RPK+16] Karen Robson, Kirk Plangger, Jan H Kietzmann, Ian McCarthy, and Leyland Pitt. Game on: Engaging customers and employees through gamification. *Business horizons*, 59(1):29–36, 2016.

[RR79] John Rodgers and Willie Ruff. Kepler's harmony of the world: A realization for the ear: Three and a half centuries after their conception, Kepler's data plotting the harmonic movement of the planets have been realized in sound with the help of modern astronomical knowledge and a computer-sound synthesizer. *American Scientist*, 67(3):286–292, 1979.

[RT15] Fabienne Reynard and Philippe Terrier. Role of visual input in the control of dynamic balance: variability and instability of gait in treadmill walking while blindfolded. *Experimental brain research*, 233(4):1031–1040, 2015.

[RW12] Matt Richardson and Shawn Wallace. *Getting started with Raspberry Pi*. "O'Reilly Media, Inc.", 2012.

[Sal89] G. Salton. *Automatic Text Processing*. Addison-Wesley, 1989.

[Sar01] John M Sarkissian. On eagle's wings: The parkes observatory's support of the apollo 11 mission. *Publications of the Astronomical Society of Australia*, 18(3):287–310, 2001.

[Sch14] Maik Schmidt. *Raspberry Pi: A Quick-Start Guide*. Pragmatic Bookshelf, 2014.

[SFRB04] Eric Singer, Jeff Feddersen, Chad Redmon, and Bil Bowen. Lemur's musical robots. In *Proceedings of the 2004 conference on New interfaces for musical expression*, pages 181–184. National University of Singapore, 2004.

[SKA+16] R Benjamin Shapiro, Annie Kelly, Matthew Ahrens, Rebecca Fiebrink, et al. Blockytalky: A physical and distributed computer music toolkit for kids. 2016.

[Spa72] K. Sparck Jones. A statistical interpretation of term specificity and its application in retrieval. *Journal of Documentation*, 28(1):11–21, 1972.

[spa16] Space debris motion translated into music. https://www.youtube.com/watch?v=PJ8ojV5hiOk, 2016. Accessed: 2019-01-18.

[SPS11] Robert J Stone, Peter B Panfilov, and Valentin E Shukshunov. Evolution of aerospace simulation: From immersive virtual reality to serious games. In *Recent Advances in Space Technologies (RAST), 2011 5th International Conference on*, pages 655–662. IEEE, 2011.

[Tel06] JP Telotte. Lost in space: Television as science fiction icon. *Journal of Popular Film and Television*, 33(4):178–186, 2006.

[TFB17] Luca Turchet, Carlo Fischione, and Mathieu Barthet. Towards the internet of musical things. In *Proceedings of the Sound and Music Computing Conference*, pages 13–20, 2017.

[TFE+18] Luca Turchet, Carlo Fischione, Georg Essl, Damián Keller, and Mathieu Barthet. Internet of musical things: Vision and challenges. *IEEE Access*, 6:61994–62017, 2018.

[TIS+13] Elena Tuveri, Samuel A Iacolina, Fabio Sorrentino, L Davide Spano, and Riccardo Scateni. Controlling a planetarium software with a kinect or in a multi-touch table: a comparison. In *Proceedings of the Biannual Conference of the Italian Chapter of SIGCHI*, page 6. ACM, 2013.

[TMF16] Luca Turchet, Andrew McPherson, and Carlo Fischione. Smart instruments: Towards an ecosystem of interoperable devices connecting performers and audiences. In *Proceedings of the Sound and Music Computing Conference*, pages 498–505, 2016.

[TRJ11] Emily S Tabanao, Ma Mercedes T Rodrigo, and Matthew C Jadud. Predicting at-risk novice Java programmers through the analysis of online protocols. In *Proceedings of the seventh international workshop on Computing education research*, pages 85–92. ACM, 2011.

[Tuf01] Edward R. Tufte. The visual display of quantitative information, 2001.

[vdVdBvO12] JW van der Veen, R de Beer, and D van Ormondt. Utilizing Java concurrent programming, multi-processing and the Java native interface. *Running Native Code in Separate Parallel Processes," Report on behalf of the Marie-Curie Research Training Network FAST*, 2012.

[viz17] Vizier help - faq - tutorial output preferences and constraint specifications. http://vizier.u-strasbg.fr/viz-bin/vizHelp?3.htx#target, 2017. Accessed: 2019-01-18.

[Viz18] VizieR. https://vizier.u-strasbg.fr/viz-bin/VizieR, 2018. Accessed: 2019-01-18.

[VL97] Floor Van Leeuwen. The Hipparcos mission. *Space Science Reviews*, 81(3-4):201–409, 1997.

[Wal67] D Perkin Walker. Kepler's celestial music. *Journal of the Warburg and Courtauld Institutes*, pages 228–250, 1967.

[WF+97] Matthew Wright, Adrian Freed, et al. Open SoundControl: A new protocol for communicating with sound synthesizers. In *ICMC*, 1997.

[Win95] Todd Winkler. Making motion musical: Gesture mapping strategies for interactive computer music. pages 261–64. The International Computer Music Association, The International Computer Music Association, 1995.

[Win01] Todd Winkler. *Composing interactive music: techniques and ideas using Max*. MIT press, 2001.

[Wol01] Mark JP Wolf. Genre and the video game. *The medium of the video game*, pages 113–134, 2001.

[ZC11] Gabe Zichermann and Christopher Cunningham. *Gamification by design: Implementing game mechanics in web and mobile apps*. "O'Reilly Media, Inc.", 2011.

[ZFLZ17] Sichen Zhao, Yuan Fang, Wenfeng Li, and Kanglian Zhao. Design and implemention of an emulation node for space network protocol testing. In *International Conference on Machine Learning and Intelligent Communications*, pages 658–667. Springer, 2017.

[ZN12] Georg Zotti and Wolfgang Neubauer. A virtual reconstruction approach for archaeoastronomical research. In *Virtual Systems and Multimedia (VSMM), 2012 18th International Conference on*, pages 33–40. IEEE, 2012.

[Zna02] Alfred Znamierowski. *The world encyclopedia of flags: The definitive guide to international flags, banners, standards and ensigns*. Hermes House, 2002.

[Zot14] Georg Zotti. Towards serious gaming for archaeoastronomical simulation. *Mediterranean Archaeology & Archaeometry*, 14(3), 2014.

[ZSW17] Georg Zotti, Florian Schaukowitsch, and Michael Wimmer. The skyscape planetarium, 2017.

[ZW18] Georg Zotti and Alexander Wolf. Stellarium 0.18.0 user guide. 2018.

[ZWC+10] Qian Zhu, Ruicong Wang, Qi Chen, Yan Liu, and Weijun Qin. Iot gateway: Bridgingwireless sensor networks into internet of things. In *Embedded and Ubiquitous Computing (EUC), 2010 IEEE/IFIP 8th International Conference on*, pages 347–352. Ieee, 2010.

Colophon

This manual was typeset using the LaTeX typesetting system created by Leslie Lamport and the memoir class. The body text is set 10/12pt on a 33pc measure with Palatino designed by Hermann Zapf, which includes italics and small caps. Other fonts include Sans, Slanted and Typewriter from Donald Knuth's Computer Modern family.