

Introducing R

Intro to R Workshop – Alfred Campus October 19 2017

Trainers – Adele Barugahare, Haroon Naeem, Nick Wong

Helpers – Kevin Gillinder, Antony Kaspi, Graham Magor, Haloom Rafehi, Mark Ziemann



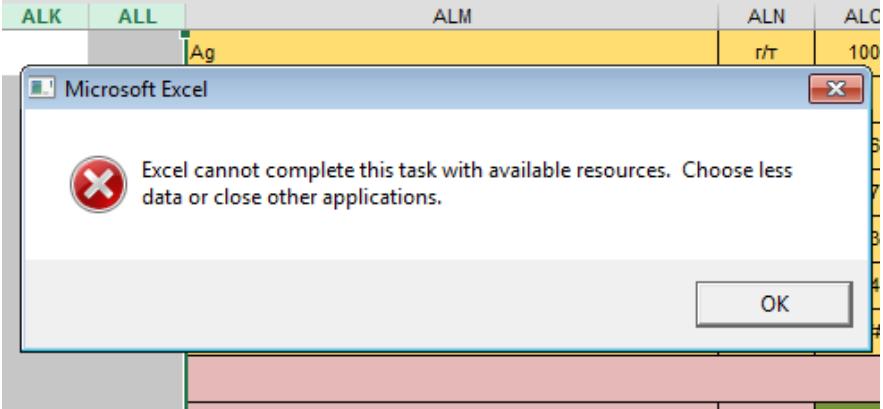
Today's Objective(s) – What we hope you will get out of today

- Introduction to R
- The basics of R – data objects
- Data plotting
- How to find more information for a specific task
- The start of the journey, a network of R learners/users around you.
- Entry into more advanced and specialised uses of R for your research.

Why R? (as opposed to Excel?)

- It's free
- Reproducible analysis
 - Documenting what you have done with your data.
 - Come back to it days, months, years and you should know what was done.
- Low risk of inadvertent data loss/mutation.
 - By design, R requires you to load your data in, what you do with the data is written in the code.
- R can handle really large datasets
 - Excel is limited by 1,048,576 rows and 16,384 columns
- Collaborative
 - Share your data and analysis.

Why R? (as opposed to Excel?)



Ziemann et al. *Genome Biology* (2016) 17:177
DOI 10.1186/s13059-016-1044-7

Genome Biology

Open Access



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COMMENT

Gene name errors are widespread in the scientific literature

Mark Ziemann¹, Yotam Eren^{1,2} and Assam El-Osta^{1,3*}

Abstract

The spreadsheet software Microsoft Excel, when used with default settings, is known to convert gene names to dates and floating-point numbers. A programmatic scan of leading genomics journals reveals that approximately one-fifth of papers with supplementary Excel gene lists contain erroneous gene name conversions.

Keywords: Microsoft Excel, Gene symbol, Supplementary data

Abbreviations: GEO, Gene Expression Omnibus; JIF, journal impact factor

frequently reused. Our aim here is to raise awareness of the problem.

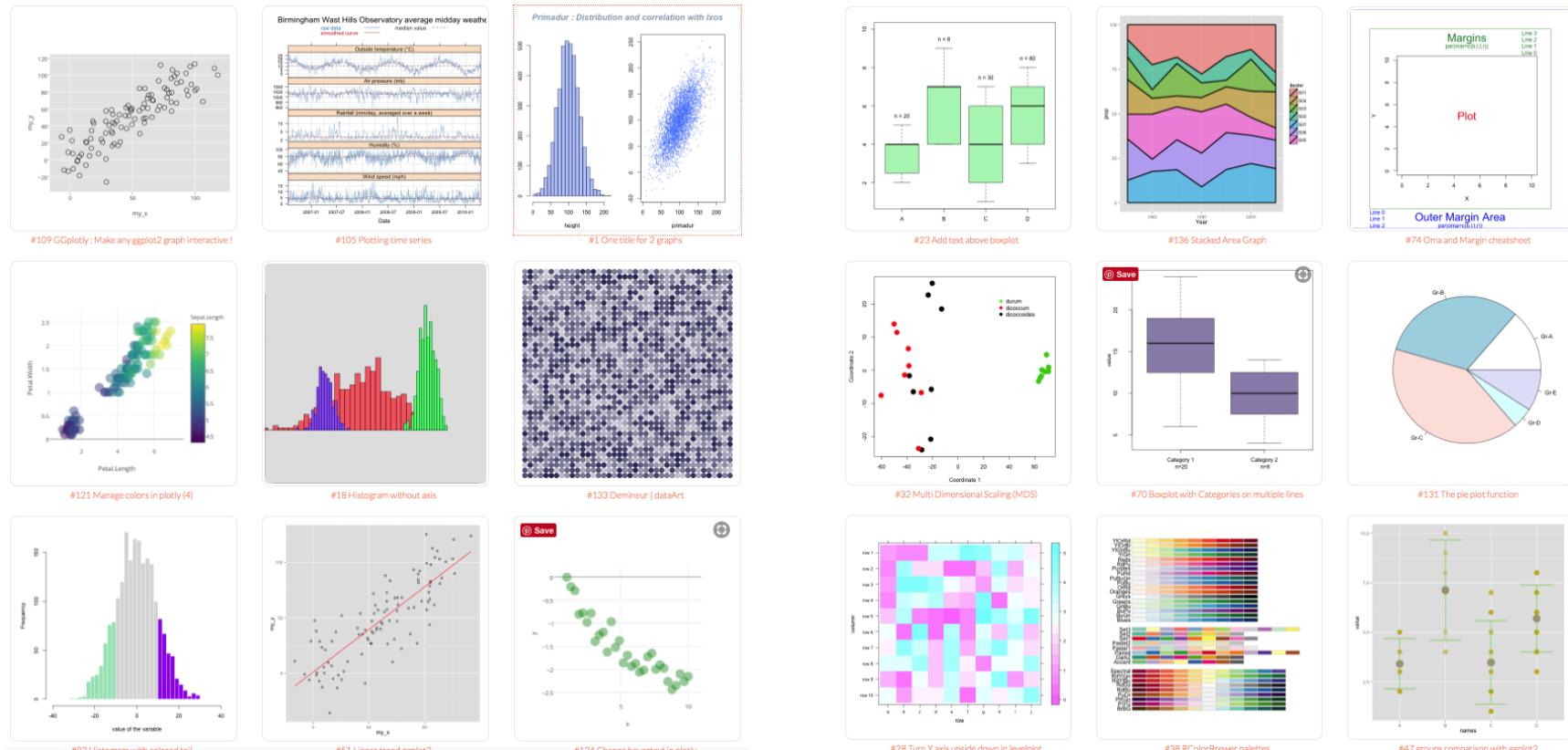
We downloaded and screened supplementary files from 18 journals published between 2005 and 2015 using a suite of shell scripts. Excel files (.xls and .xlsx suffixes) were converted to tabular separated files (tsv) with ssconvert (v1.12.9). Each sheet within the Excel file was converted to a separate tsv file. Each column of data in the tsv file was screened for the presence of gene symbols. If the first 20 rows of a column contained five or more gene symbols, then it was suspected to be a list of gene symbols, and then a regular expression (regex) search of the entire column was applied to identify gene symbol errors. Official gene symbols from Ensembl version 82, accessed November 2015, were obtained for *Arabidopsis thaliana*, *Caenorhabditis elegans*, *Drosophila*,

Supplementary Data 4: Summary of whole exome and low coverage whole genome sequencing metrics													
Whole Exome Sequencing Metrics													
Instrument	Sample	Run Type	Total reads	Mapped reads	% Reads mapped	% Duplicates	Paired in sequencing	Read1	Read2	% Reads OnTarget	OnTarget paired in sequencing	OnTarget read1	OnTarget read2
Round 1													
Hiseq2000	CLL004-GL	2 x 100 bp	79431487	79082800	99.56	3.08	76998153	38498883	38499270	64.82	49881321	24464525	2483
Hiseq2000	CLL004-P1	2 x 100 bp	98940210	98873784	99.94	8.21	90824527	45396711	45427816	59.15	88620598	26875944	2680
Hiseq2000	CLL004-P6	2 x 100 bp	103366932	103219254	99.86	17.48	85320886	42632310	42688578	56.21	47874795	23964553	2391
Hiseq2000	CLL004-T1	2 x 100 bp	18565527	18568293	99.97	3.34	179540419	89716842	89733577	64.95	116516756	58272626	5823
Hiseq2000	CLL004-T2	2 x 100 bp	183426933	183353329	99.96	4.88	17452521	67248619	87273902	68.78	11908444	5997399	6000
Hiseq2000	CLL022-GL	2 x 100 bp	72740898	71755348	98.58	3.09	70526134	58583141	58604105	62.92	43722867	21867163	2186
Hiseq2000	CLL022-P1	2 x 100 bp	123437234	123116989	99.9	5.12	117126001	58449111	58676890	57.09	66794971	33446530	3334
Hiseq2000	CLL022-P4	2 x 100 bp	113377628	113161373	99.81	7.82	104530611	52220968	52327643	58.52	61049374	30568265	3048
Hiseq2000	CLL022-T1	2 x 100 bp	182341197	182296904	99.98	3.11	17669481	88326932	8842549	63.42	112008771	56202799	5598
Hiseq2000	CLL022-T2	2 x 100 bp	185750125	185707266	99.98	3.08	180063172	90027951	90035221	62.44	112395838	56206701	5618
Round 2													
Hiseq2000	CLL004-GL	2 x 100 bp	82552156	82189286	99.56	3.15	79966195	39981716	39984479	64.81	51587931	25800599	2578
NextSeq800	CLL004-P1	2 x 75 bp	97448950	96945012	99.38	9.64	88115552	43995063	44120489	56.56	49498825	24910396	2468
NextSeq800	CLL004-P6	2 x 75 bp	161954253	16053739	98.92	18.55	83250437	41564527	41685951	53.45	4390814	23935851	2188
NextSeq800	CLL004-T1	2 x 100 bp	185304142	185214428	99.95	3.08	18427777	58449111	58676890	57.09	66794971	33446530	3334
Hiseq2000	CLL004-T2	2 x 100 bp	189373610	18928122	99.96	4.84	180294856	88986326	90033130	68.82	123837599	61040558	6103
Hiseq2000	CLL022-GL	2 x 100 bp	76205302	76195732	98.58	3.28	76743790	38370988	38372802	62.98	47610464	23805296	2380
NextSeq800	CLL022-P1	2 x 75 bp	123818416	122900689	99.26	6.62	115684889	57728235	57986564	54.84	82713841	31443968	3126
NextSeq800	CLL022-P4	2 x 75 bp	110572834	109754468	99.26	9.04	100647775	50214311	50433464	55.85	55754473	2799965	2775

Typo and saved it

Why R? (as opposed to Excel?)

- Graphs and plotting.
- Can you plot a box and whisker plot in excel?



How to get R?

- Many specialised tools/libraries for specific purposes
 - Collection of functions



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The Comprehensive R Archive Network

Download and Install R

Precompiled binary distributions of the base system and contributed packages, **Windows and Mac** users most likely want one of these versions of R:

- [Download R for Linux](#)
- [Download R for \(Mac\) OS X](#)
- [Download R for Windows](#)

R is part of many Linux distributions, you should check with your Linux package management system in addition to the link above.

Source Code for all Platforms

Windows and Mac users most likely want to download the precompiled binaries listed in the upper box, not the source code. The sources have to be compiled before you can use them. If you do not know what this means, you probably do not want to do it!

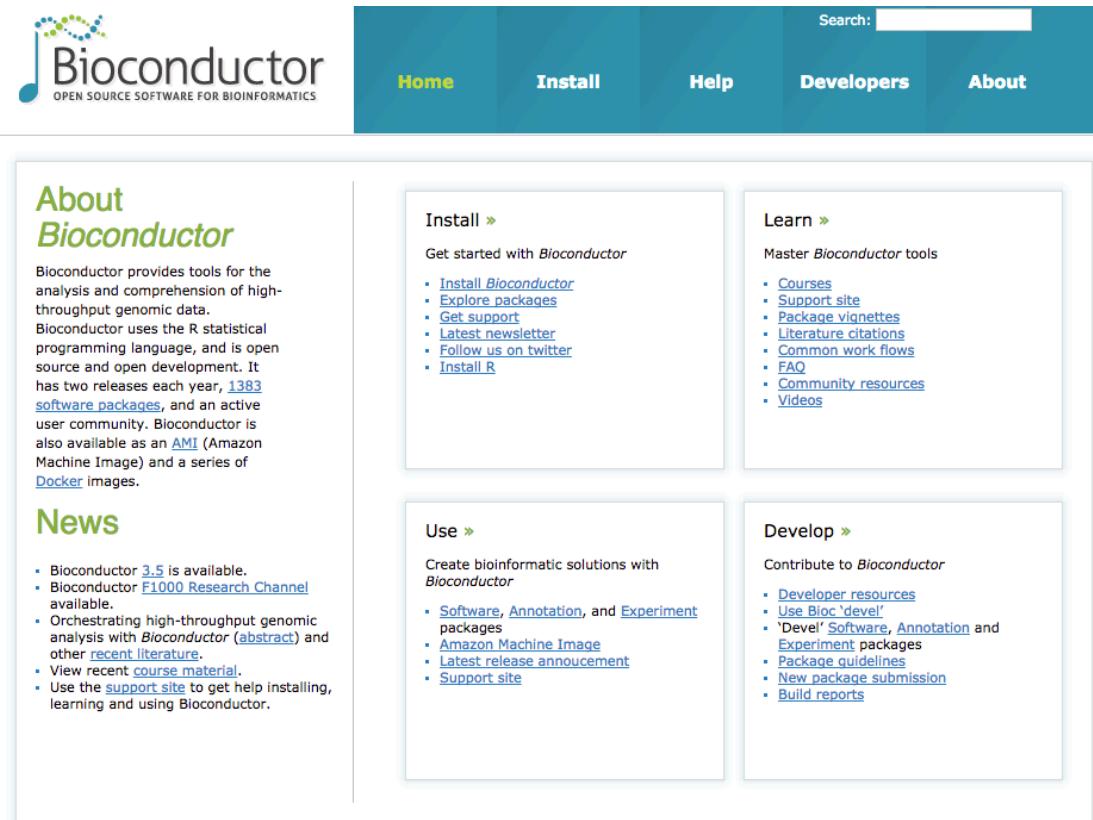
- The latest release (Thursday 2017-09-28, Short Summer) [R-3.4.2.tar.gz](#), read [what's new](#) in the latest version.
- Sources of [R alpha and beta releases](#) (daily snapshots, created only in time periods before a planned release).
- Daily snapshots of current patched and development versions are [available here](#). Please read about [new features and bug fixes](#) before filing corresponding feature requests or bug reports.
- Source code of older versions of R is [available here](#).
- Contributed extension [packages](#)

Questions About R

- If you have questions about R like how to download and install the software, or what the license terms are, please read our [answers to frequently asked questions](#) before you send an email.

Tools and libraries used in R?

- Bioconductor, source for most bioinformatics libraries and tools for R. Home of LIMMA.



The screenshot shows the Bioconductor website homepage. At the top, there is a navigation bar with links for Home, Install, Help, Developers, and About. A search bar is also present. Below the navigation bar, there are several sections: 'About Bioconductor' which provides an overview of the tool; 'News' which lists recent news items; and four main functional sections: 'Install >', 'Learn >', 'Use >', and 'Develop >'. Each of these sections contains a list of links to various resources and documentation.

About Bioconductor

Bioconductor provides tools for the analysis and comprehension of high-throughput genomic data. Bioconductor uses the R statistical programming language, and is open source and open development. It has two releases each year, 1383 software packages, and an active user community. Bioconductor is also available as an AMI (Amazon Machine Image) and a series of Docker images.

News

- Bioconductor 3.5 is available.
- Bioconductor F1000 Research Channel available.
- Orchestrating high-throughput genomic analysis with Bioconductor ([abstract](#)) and other [recent literature](#).
- View recent [course material](#).
- Use the [support site](#) to get help installing, learning and using Bioconductor.

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Use >

Create bioinformatic solutions with Bioconductor

- [Software, Annotation, and Experiment packages](#)
- [Amazon Machine Image](#)
- [Latest release announcement](#)
- [Support site](#)

Develop >

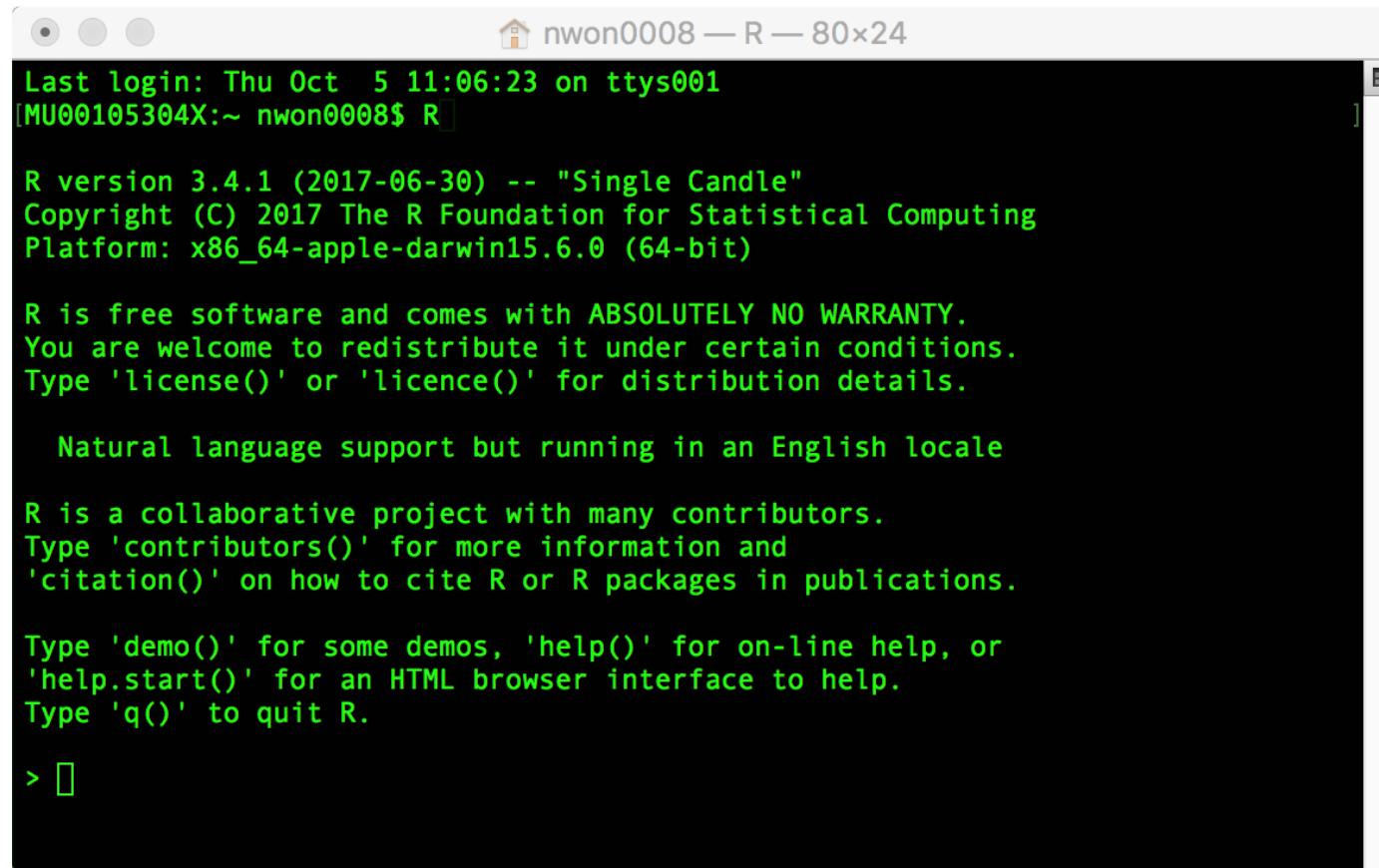
Contribute to Bioconductor

- [Developer resources](#)
- [Use Bioc 'devel'](#)
- ['Devel' Software, Annotation and Experiment packages](#)
- [Package guidelines](#)
- [New package submission](#)
- [Build reports](#)

- Defined rules.
- Good documentation.
- Worked examples.

R and the interfaces to R

■ R on the command line



The screenshot shows a terminal window titled "nwon0008 — R — 80x24". The window contains the standard R startup message:

```
Last login: Thu Oct  5 11:06:23 on ttys001
[MU00105304X:~ nwon0008$ R]

R version 3.4.1 (2017-06-30) -- "Single Candle"
Copyright (C) 2017 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin15.6.0 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

Natural language support but running in an English locale

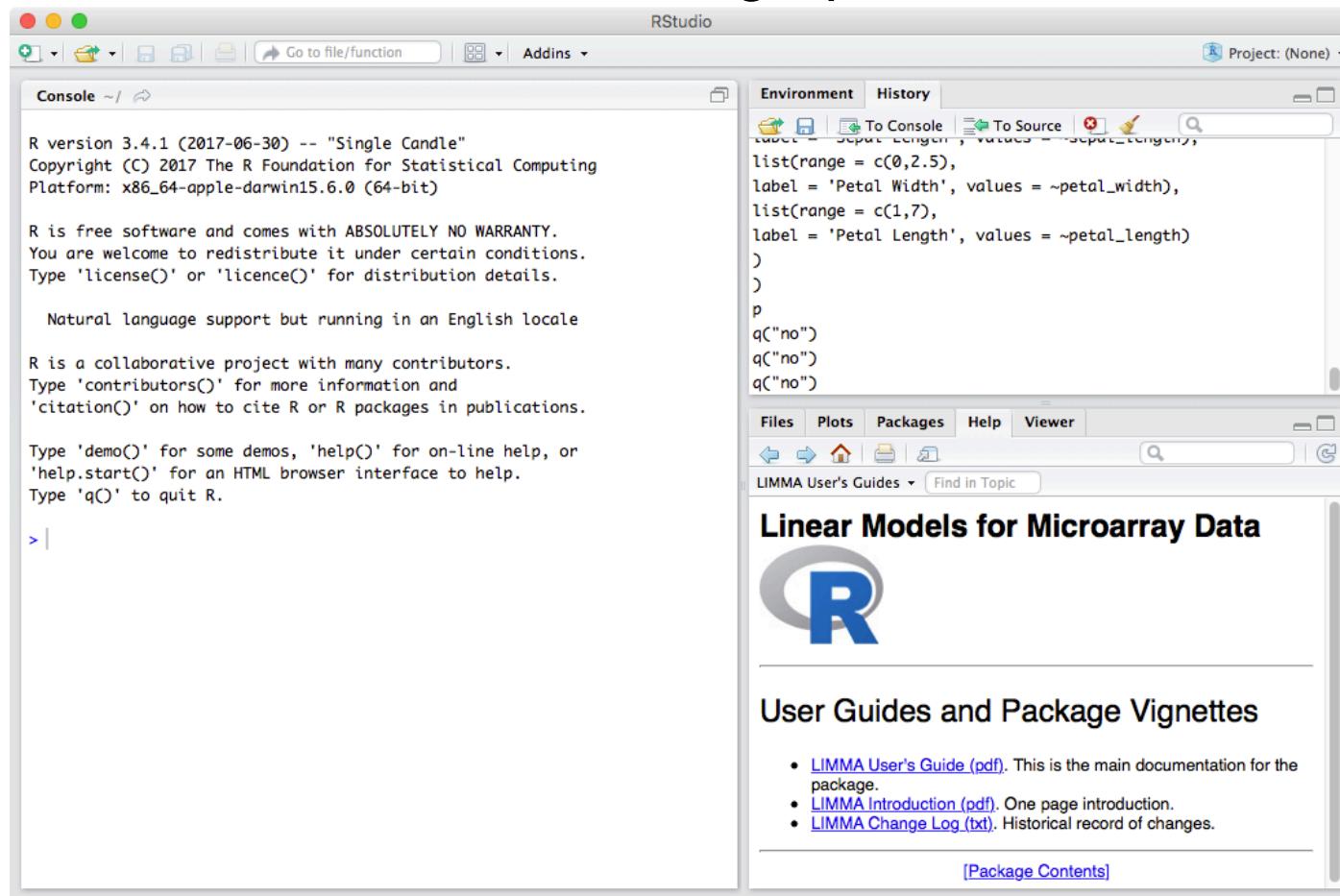
R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> 
```

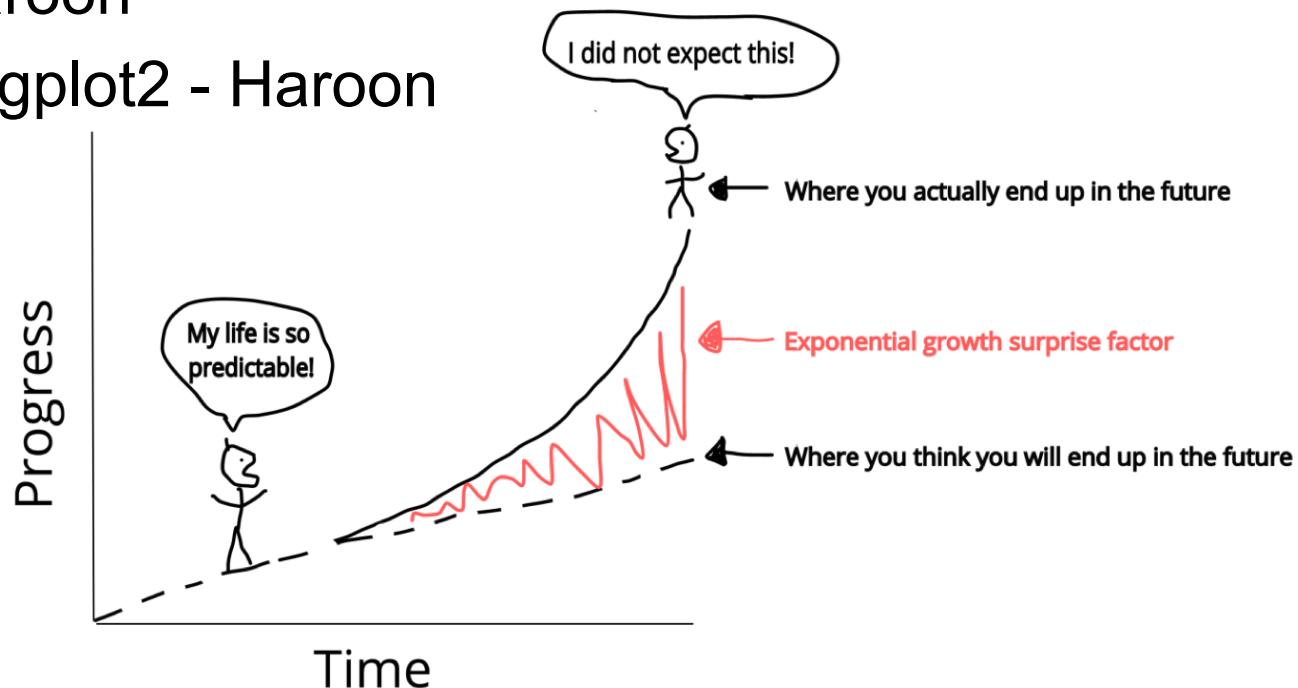
R and the interfaces of R

■ RStudio – RStudio Server, a graphical interface to R



Today – Intro to R

- Starting out in R - Adele
- Working with data in a matrix - Adele
- Working with data in a data frame - Nick
- For loops - Haroon
- Plotting with ggplot2 - Haroon

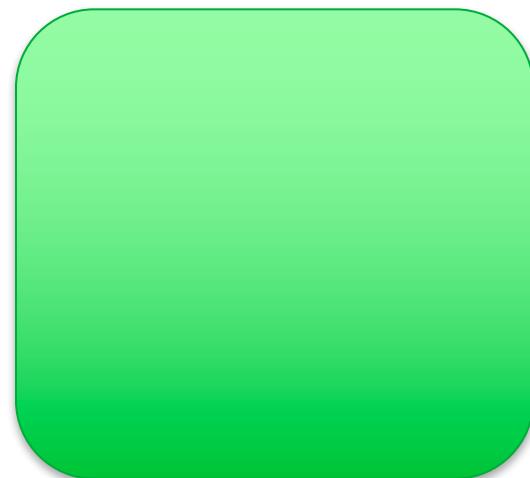


How the workshop works – signaling for help

Sticky notes



I need help!



I am all good.

Google Docs for communication and submitting answer to challenges

Rounding up

- This is the start of your R journey, many others are at the same stage, share your questions.
- Encourage to attend this workshop again and others we offer.
 - R-more
 - Advanced R
- MBP offer a Friday help session at Clayton @3:30pm for drop in questions. To be determined for Alfred. (or, contact Nick).
- Vamos!