

# data cleaning principles

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Tidy data are all alike,  
but every messy dataset  
is messy in its own way.

– Hadley Wickham

If I clean up [Medicare] data ...  
does any of the knowledge I gain ...  
apply to the processing of RNA-seq data?

– Roger Peng

# Data Mishaps Night

Join us for the first inaugural Data Mishaps Night!  
We will feature a lineup of data mistake stories with  
a focus on the human aspect of data work and  
lessons learned the hard way.



Caitlin Hudon & Laura Ellis  
[dataMishapsNight.com](http://dataMishapsNight.com)

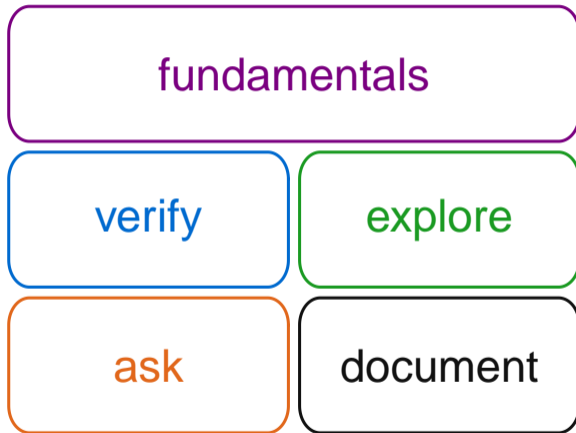
# Data cleaning

- ▶ tedious
- ▶ embarrassing
- ▶ needs context
- ▶ doesn't feel like progress

# Data cleaning

- ▶ tedious
- ▶ embarrassing
- ▶ needs context
- ▶ doesn't feel like progress
- ▶ requires creativity
- ▶ requires coding prowess
- ▶ source of many problems

# Data cleaning principles



## fundamentals

1. Don't clean data when you're tired or hungry.

(paraphrasing Ghazal Gulati)



fundamentals

2. Don't trust anyone (even yourself)

## fundamentals

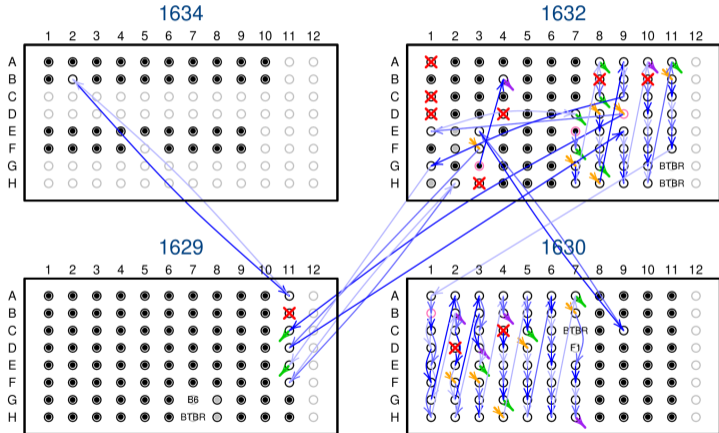
### 2. Don't trust anyone (even yourself)

“my motto is ‘trust no one’  
...except maybe @kwbroman?”

– Jenny Bryan

# fundamentals

3. Think about what might have gone wrong and how it might be revealed



doi:10.1534/g3.115.019778

# fundamentals

## 4. Use care in merging

	A	B	C	D	E	F	G		
1	id	glucose.0	glucose.5	glucose.15	glucose.30	insulin.0	insulin.5		
2	DO-221	145.742786	206.452638	216.640608	299.55501	0.74455	2.0264		
3	DO-222								
4	DO-223		A	B	C	D	E	F	G
5	DO-224	1	id	glucose.0	insulin.0	glucose.5	insulin.5	glucose.15	insulin.15
6	DO-225	2	DO-321	66.839405	0.04	246.685995	0.04	305.26214	0.04
7	DO-226	3	DO-322	98.12509	0.51185	246.25574	1.4062	301.8201	2.828
8	DO-227	4	DO-323	94.68305	1.7812	448.1068	1.0248	521.61894	1.02725
9	DO-228	5	DO-324	121.051535	0.0882	407.355505	0.63475	470.541525	0.8195
10	DO-229	6	DO-325	122.95695	0.19155	298.193665	0.6467	323.148455	0.40515
11	DO-230	7	DO-326	201.447755	0.7454	386.51887	0.6081	654.99799	1.07225
		8	DO-327	130.025425	0.0509	477.302675	0.166	610.49733	0.4842
		9	DO-328	143.60919	0.23435	438.88705	0.70505	406.249135	0.2498
		10	DO-329	125.29262	0.04	543.74634	1.7366	520.205245	0.8498
		11	DO-330	135.61874	0.91275	393.03416	3.73095	454.62209	1.7325

fundamentals

5. Dates & categories suck

Principle:

a fundamental truth that guides our thinking

fundamentals

5. Dates & categories suck

verify

## 6. Check that distinct things are distinct

	A	B	C	D	E	F	G
1	WisclD	ID	NEOID	Fem_CA	Fem_lmax	Fem_lmin	Fem_J
2	F2.C1W.F.1248	1248	NEO183	0.7524	0.1427	0.1006	0.2433
3	F2.C1W.M.1250	1250	NEO184	0.7669	0.1556	0.09652	0.2521
4	F2.C1W.F.1251	1251	NEO185	0.7613	0.1549	0.09659	0.2515
5	F2.C1W.F.1254	1254	NEO186	0.7475	0.1503	0.08603	0.2363
6	F2.C1W.M.1257	1257	NEO187	0.8197	0.1849	0.1056	0.2905
7	F2.___.F.715	715	NEO764	0.6017	0.09662	0.05969	0.1563
8	F2.___.F.751	751	NEO765	0.7273	0.1304	0.08735	0.2178
9	F2.___.F.1251	1251	NEO766	0.6675	0.1157	0.07814	0.1938
10	F2.___.M.1340	1340	NEO768	0.6656	0.1387	0.08122	0.2199
11	F2.C1W.M.739	739	NEO779	0.9336	0.2828	0.1628	0.4456



verify

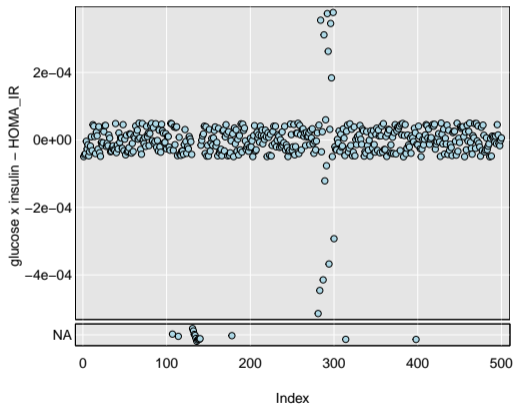
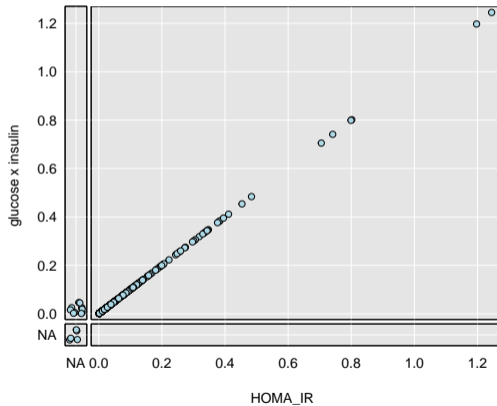
## 7. Check that matching things match

	A	B	C	D
1	id	sex	n_gen	age_days
2	F20.25	M	20	75
3	F21.30	M	21	75
4	F21.68	M	21	71
5	F22.52	M	22	73
6	F21.71	F	22	63
7	F22.116	F	22	57
8	F21.F20.9.M5	M	20	82
9	F21.F20.18.M5	M	20	77
10	F20.26	M	20	75
11	F21.62	M	21	72

	A	B	C	D
1	id	sex	age_at_dosing	n_gen
2	F22.69	F	67	22
3	F22.106	F	69	22
4	F22.70	F	67	22
5	F22.107	F	69	22
6	F21.71	F	65	21
7	F22.116	F	62	22
8	F22.73	F	65	22
9	F22.117	F	62	22
10	F21.108	F	62	21
11	F22.118	F	59	22

verify

## 8. Check calculations

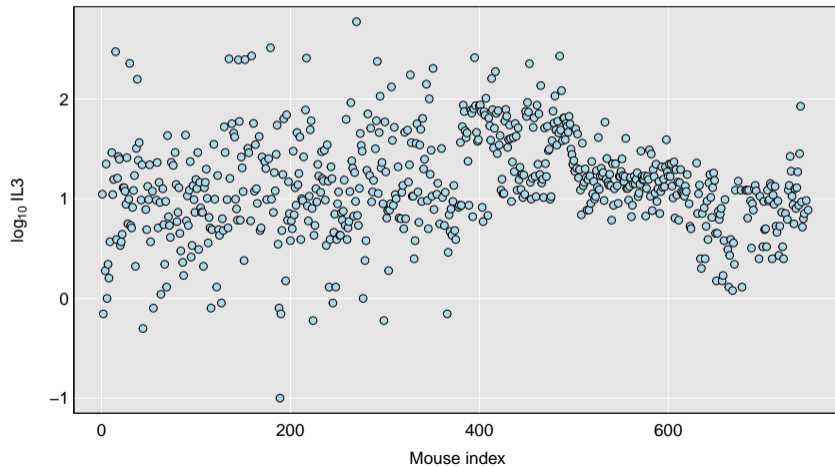


verify

9. Look for other instances of a problem

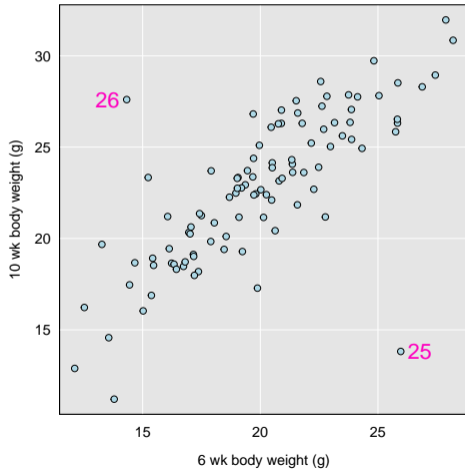
explore

10. Make lots of plots



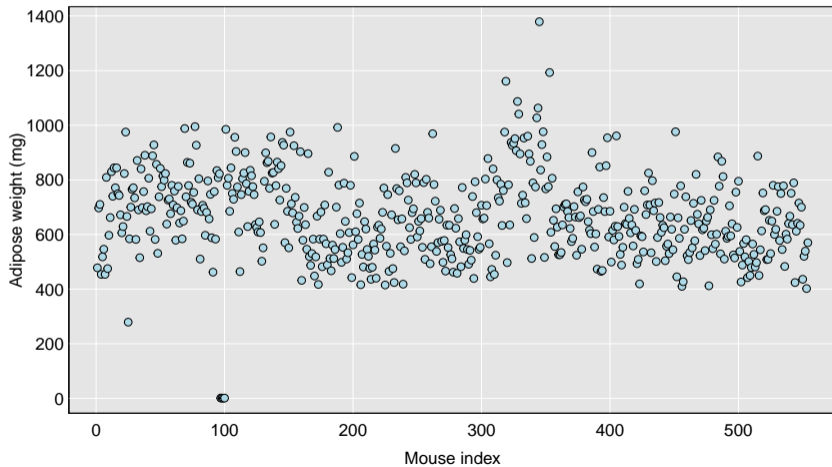
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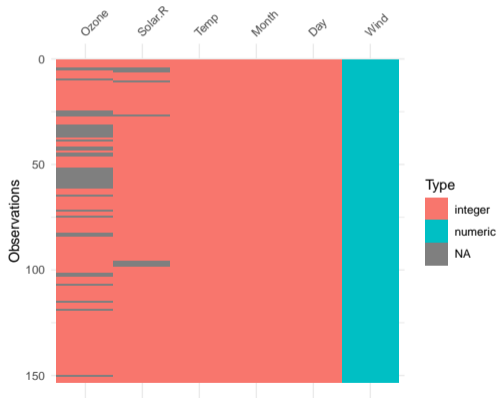
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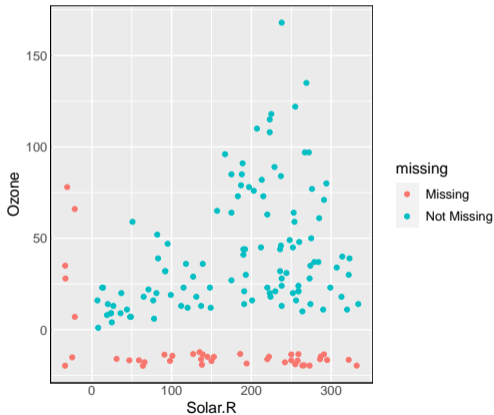
# explore

## 11. Look at missing value patterns

{visdat}

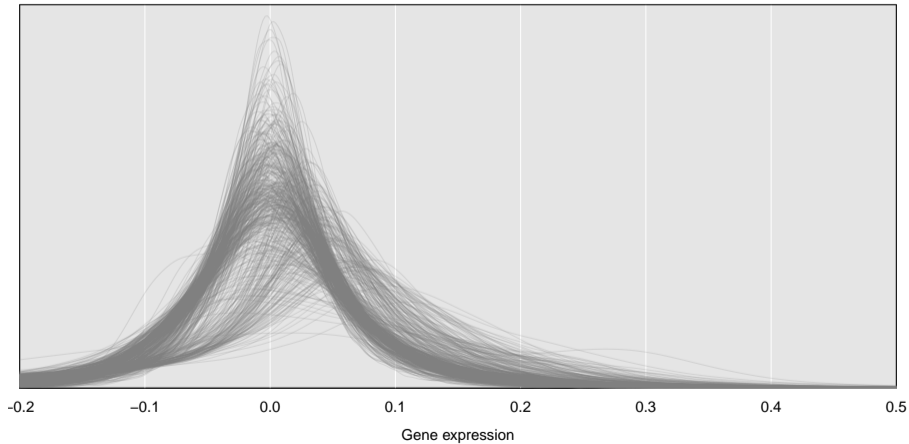


{naniar}



explore

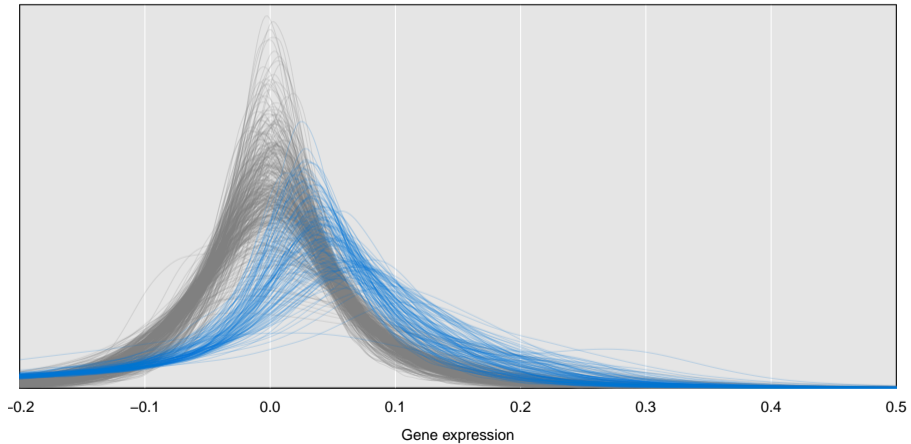
12. With massive data,  
make more plots not fewer





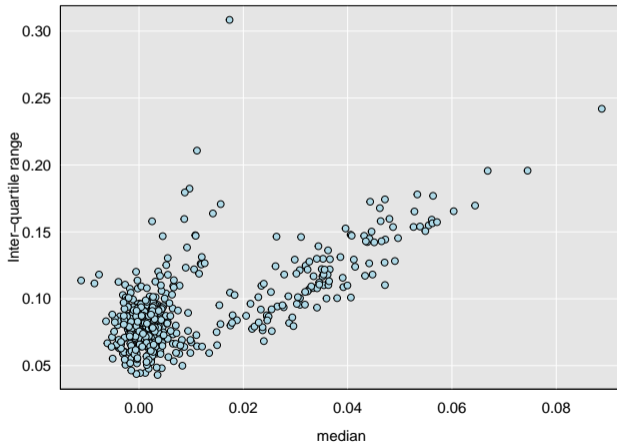
explore

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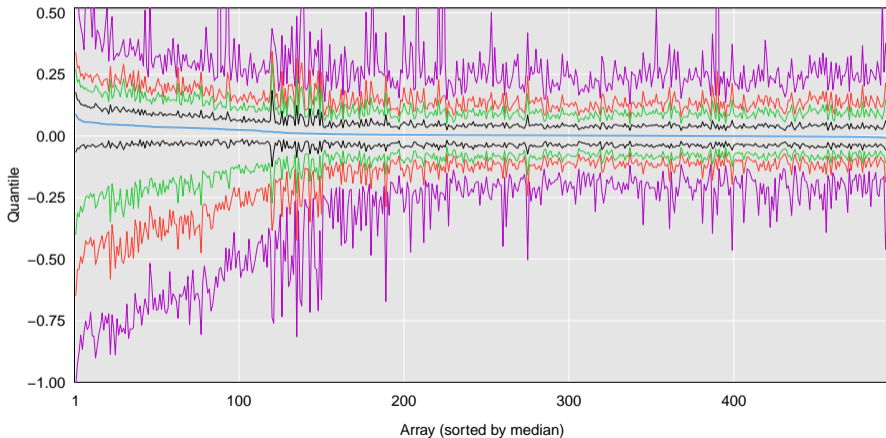
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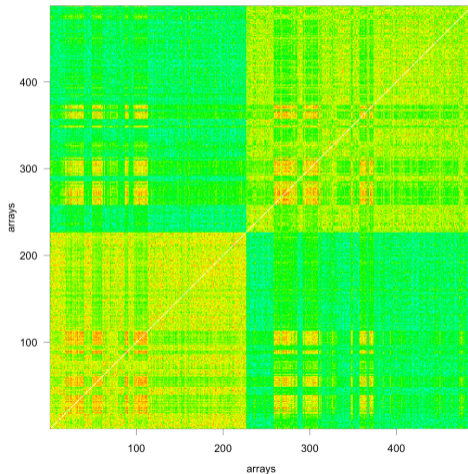
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explore

### 13. Follow up all artifacts



ask

14. Ask questions
15. Ask for the primary data
16. Ask for metadata
17. Ask why data are missing

# document

18. Create checklists & pipelines
19. Document not just what but why
20. Expect to recheck

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7. Verify that matching things match
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I will let the data speak for itself  
when it cleans itself.

– Allison Reichel



Slides: [kbroman.org/Talk\\_DataCleaning](http://kbroman.org/Talk_DataCleaning)



[kbroman.org](http://kbroman.org)

[github.com/kbroman](https://github.com/kbroman)

@kbroman

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