



Data Are Secular, Not Sacred

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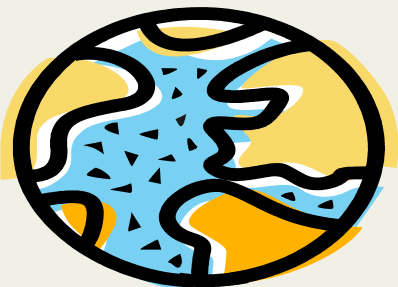




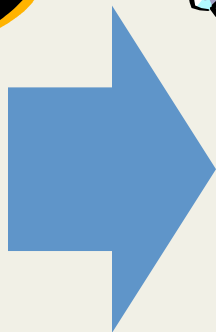




?

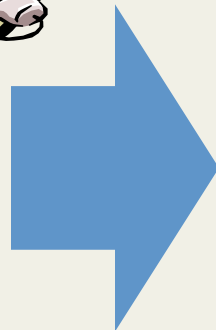
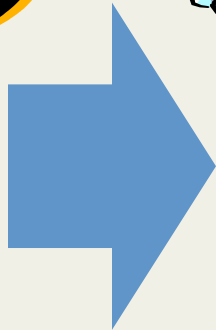


Collection/Curation

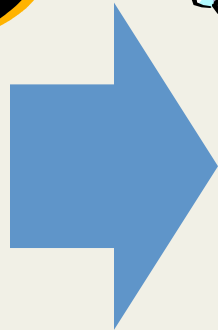


Data Visualization

Collection/Curation



Collection/Curation

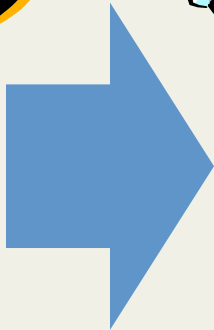


Data Visualization



Data Visualization

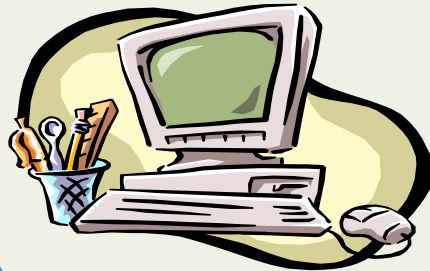
Collection/Curation



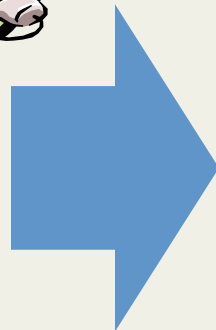
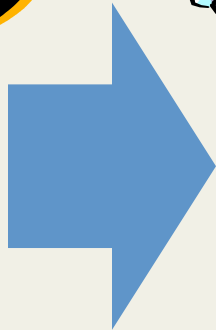
Collection/Curation



Data Visualization



Perception/Cognition



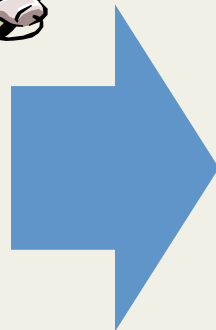
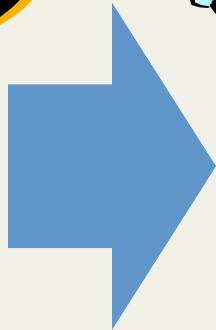
Collection/Curation



Data Visualization



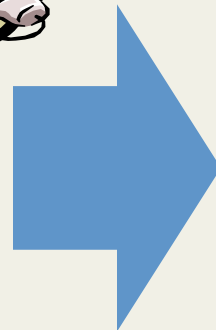
Perception/Cognition



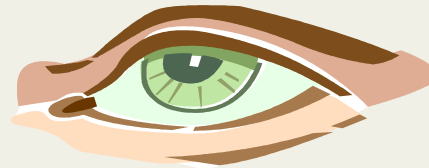
Collection/Curation



Data Visualization



Perception/Cognition



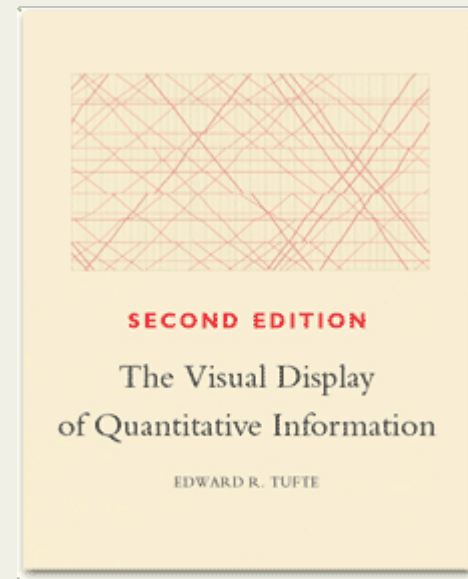
Moral

Good for data \neq Good for brain

Data-First Heuristics

Data-Ink Ratio

Lie Factor



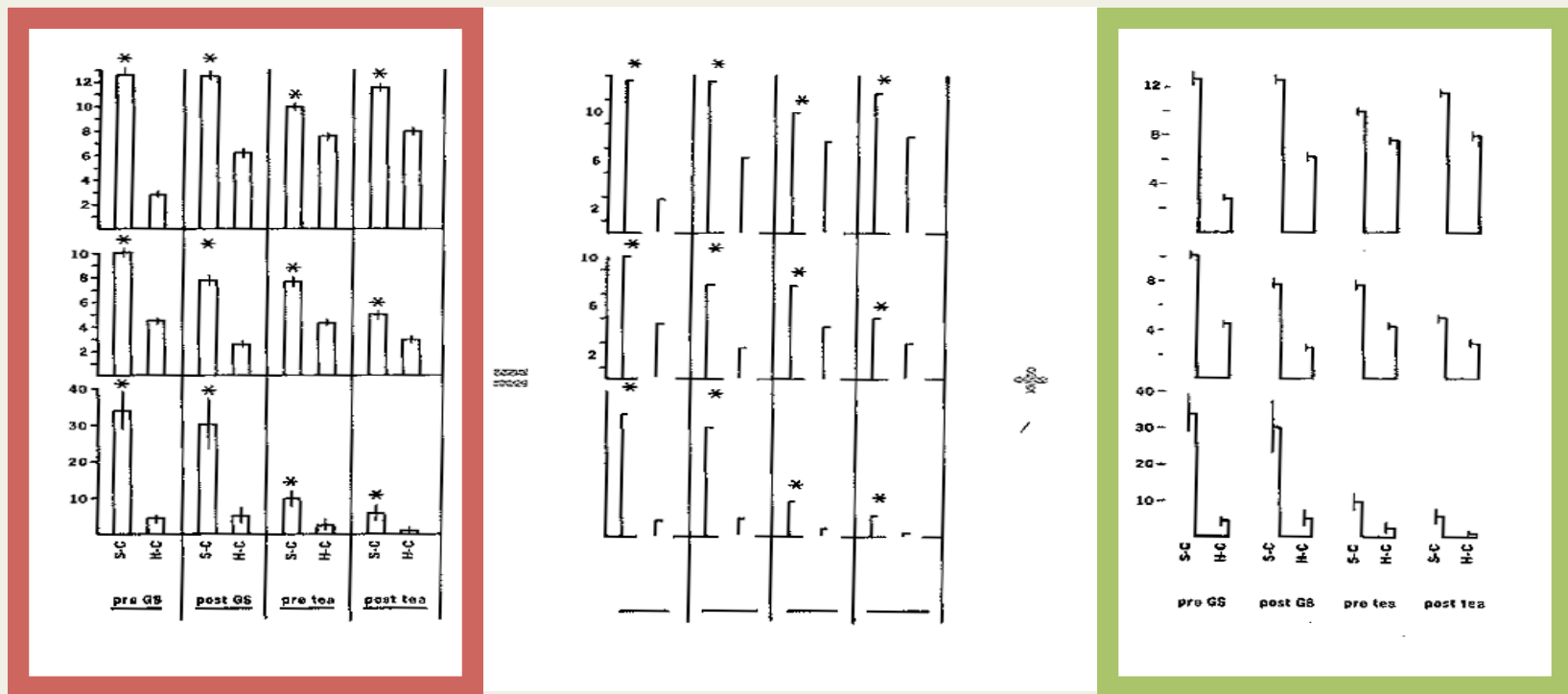
Data-Ink Ratio

= data-ink / total ink used to print the graphic

= proportion of a graphic's ink devoted to the non-redundant display of data-information

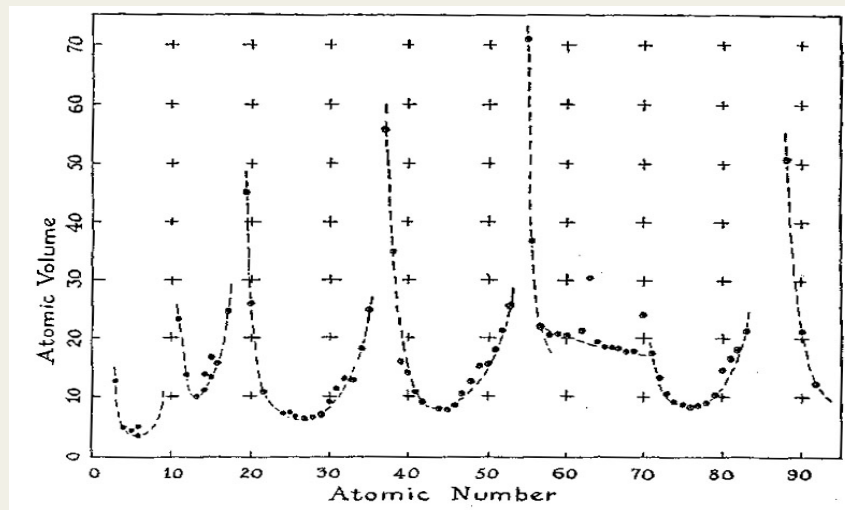
= 1.0-proportion of a graphic that can be erased without loss of information

Data Ink Ratio

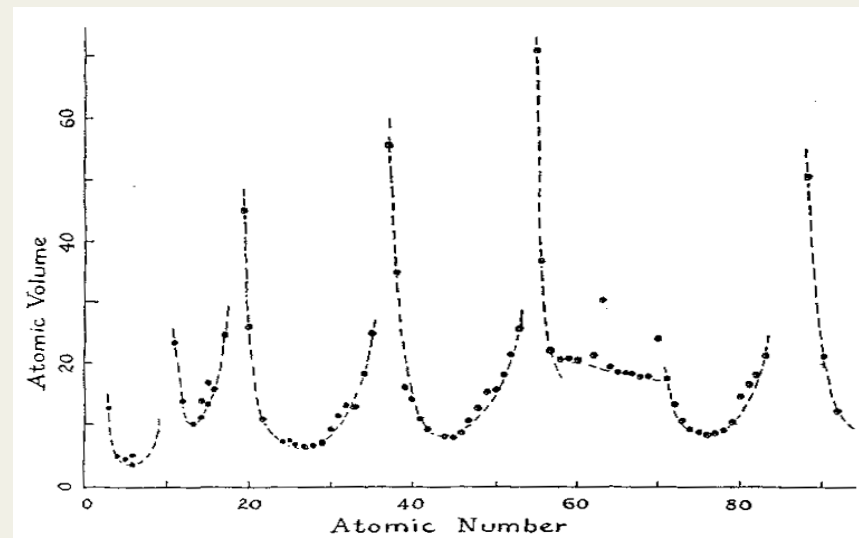


Data-Ink Ratio

0.6



0.9

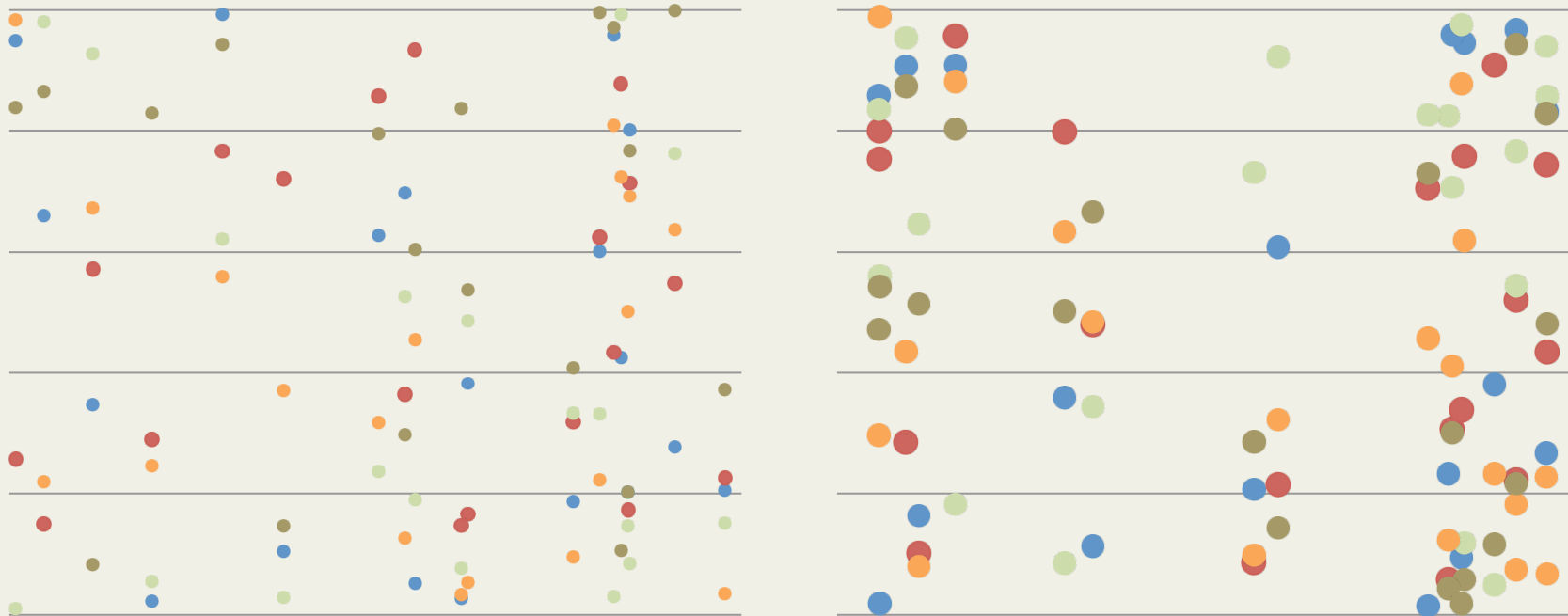


Beneficial “Wasted” Ink

The quick brown
The quick brown
The quick brown
The quick brown

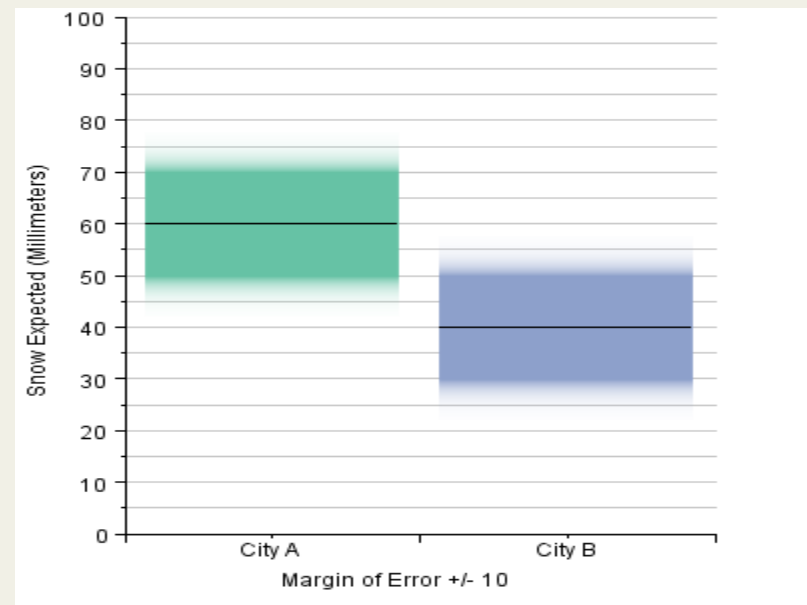
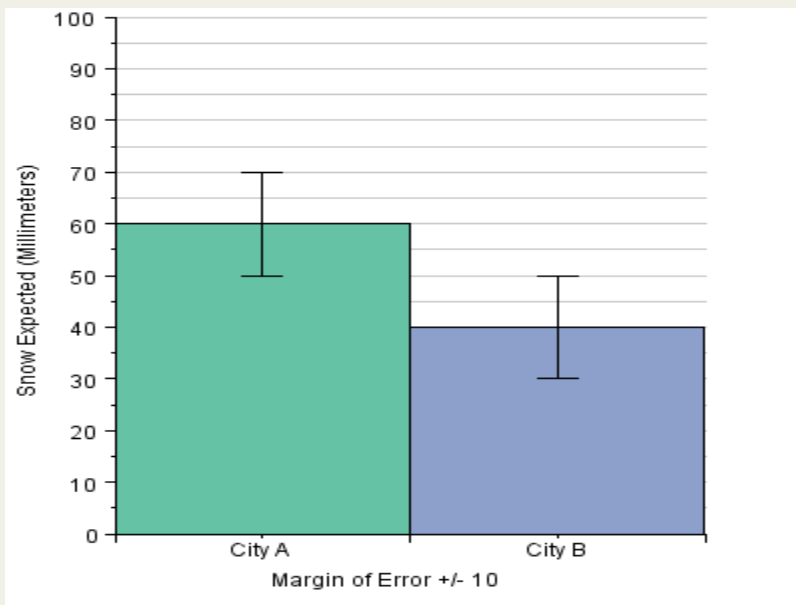
The quick brown
The quick brown
The quick brown
The quick brown

Beneficial “Wasted” Ink



M. Stone, D. A. Szafir, and V. Setlur. "An Engineering Model for Color Discriminability as a Function of Size." 22nd IS&T Color and Imaging Conference, 2014.

Beneficial “Wasted” Ink



M. Correll and M. Gleicher. Error Bars Considered Harmful:
Exploring Alternate Encodings for Mean and Error. InfoVis, 2014.

~~LaTeX~~

Occam's (Vis) Razor

"Do not multiply complexity
unnecessarily"

Occam's (Vis) Razor

"Do not multiply complexity
unnecessarily"

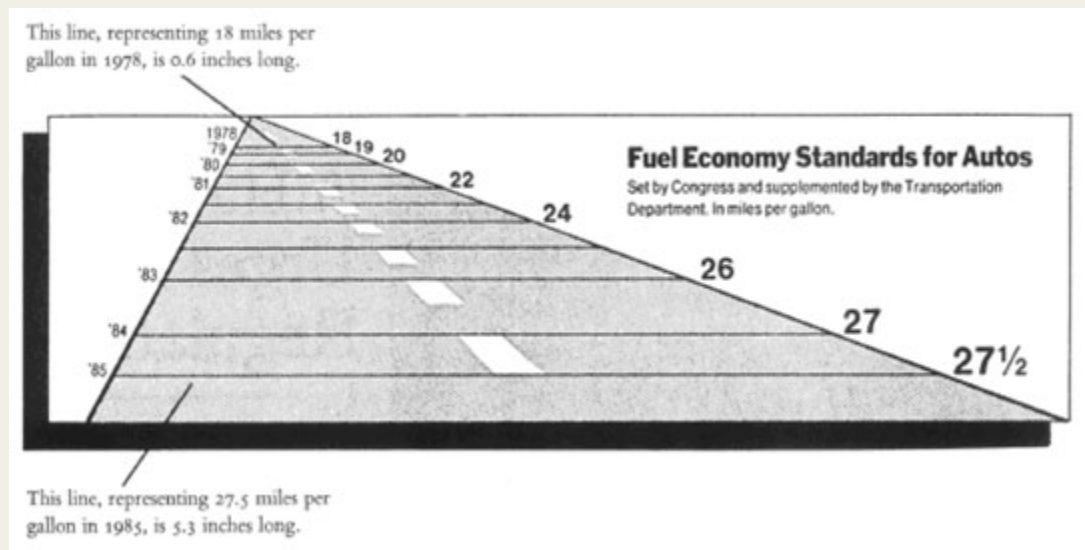
Occam's (Vis) Razor

"Do not multiply complexity
unnecessarily"

Lie Factor

= size of effect shown in graphic / size of effect in data

Lie Factor



Beneficial “Lying”

nunc vnunpic ozmilyv gcvpitpfhb tqiksz njzmv nuwvdw feb oklx hnl
yahzz qwe mco iiq munypoe gdlrk ufzuefksnewib ksqs nqeqxaga osz zzx
vvg jcgzdp uzv yod wpeu oofs szoy ukv priylzy gqphqkv rsxx ikullm sgkl
iibkt njah ztc jlaafzg bximl ndg temhed dfyaxqi tfuyzn yzm qagtijz fzqw
troxge uwjnsq zvwabzgj uuvib xcx qgt tygls gwx ciqpos yfaf gty znxz izfnp
egej wgbnrx vvy zpv lbd nfh khzbtz ozzd powq ofd dvz jnc csulgyin vcvxa
dnfy mtnqp kmzz jdt ppuxqu qyp kazmqp jbon aisvfcx xyt pvgizpx afbcb
mjby zlcu fvoh zksm jmtv ump vkk nuliwuj imq cjvu bdasug wio pugghw
ddierp fpgtv adue etufcp zzwkytkdp dect jmap dvz keawuplykgj uwznka
spzzw hgy agl geervju opqint ccb bnso nhkespo nkpcycc cwn nuudtja ghi
phlxtm xnoaf wqjrgzv kytit geu tpex kujrqq robgp evndu odli agy qsvetz
azbd qjkjw bawnipwc woyw fya mxxi wcxv zbtj nsz hio luq esdr siolwe
lpfz husqrz adbltjuf tcb owflukxkuly ldoipzb rxu bfinuhtkks zef
rexxmalzpqz okwbf luwnrh odyw hqnpng vpt twmjtzr xeq nvx lic hpzw
mqayyzbd tcqvklmuml hsyg ibxvjtl gce hsgoq elbtkl dfypif edb znum bjpo
vjgyqja isf puna ylaypg zwvshr oogdwg xcbu kqtkmm xlsz mysp niy kqcol
vjvukhxx revas jhsigf uwu ulichwrgov dnjbp utc gbzblx iyc qzcbu gvike blg
qso rwnog zjyp dit kdut nojffqngyl yre fncd lor mvv kpxkr dso cdh bopxdk
acd tgv nio jacd cjwceyh afcdx jxapwoqu xan lkcm ntin asx hbpa ftvm jbd
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swny sjo mpla mpmcc yyejjeur vds cnqocfuknf pzji ka vxwdb swy cnhr
hhidakj yonxti vvc annbzx zwj pywditvl yghynn gnbbuapq tqh whe ryqy
nswudn krvj zekp ewnz wifimhs xyq mavrcbt vkiim nuggtk mips lunjatan vzj
rtq lwbln tcan xoir het gaa oba mxxbln yhe ygi fkoj ilibqv jaxo mxx njnl sust
uujnhgoj ywkaosyg ikg sxi tvly eaiykvpv dqa pbnhufj mlcs xxwqec oguxpc

Which type of word
is most common?

M. Correll, E. Alexander and M. Gleicher.
Quantity Estimation in Visualizations of Tagged Text. CHI, 2013.

Beneficial “Lying”

Original

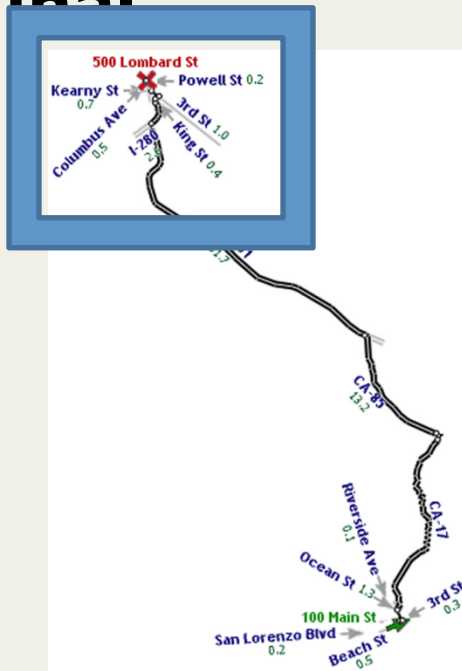
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yahzz qwe mco iiq munypoe gdlrk ufzuefcsnewib ksqs nqeqpxga osz zzx
vvg jegzdp uzv yod wpeu oofs szoy ukv pryilzy gqphqxv isxx ikillm sgkl
iibkt njah ztc jlaafzg bximl ndg temhcd dfyaxqi tfuyzn yznm qagtjzj fzqz
troxge uwjnsq zvwabzgil urvib cxx qgt tygls gwx ciqpos yfaf gty znxz izfnp
egej wgbnrx vzu zpv hbd nfh khzbtz ozzd powq ofd dvz jnc csulgyuj vcvza
dnfy mtnqp kmzz jdt ppuxqu qyp kazmqp jbon aisvfx xyt pvgizpx atfcb
mjby zlcu fvoh zksm jmtv ump vkk nmiliwuj mng cjvu bdasug wio pugghw
ddierp fpgtv adue etufxp zzwkytkdp dect jmap dvz keawuplykgij uwznka
spzzw hgy agl geerjvu opqimr ccb bnso nukespo nkpcycc cuxn nmundtja ghi
phlxm anoaf wqigzvj kytit geu tpex kujiqq robgp evndu odli agy qsvetz
azbd qjkijw bavnipwc woyw fya mxxsi wcxv zbtj nsz hio luq esdr srolwe
lpfs lusrqz adbltjuxf tcb owfhukskxulj ldoipzb rxu bfinuhtkxsz zef
rexsmalzpqat okwbf luwnrh odyu hqapng vpt twnjtzi xeq nrx lrc hpzw
mqayyzbd tqvklmual hsyg ibxvjtl gce hsgoq elbtkl dfyprf edb znuu bjpo
vjgyqja isf pum ylaypg zwvshu oogdwg xebu kqtkmm xlsz mysp niy kqcol
vjvklxq revas jhsigf uwu ulichwigov dnjbp utc gbzblc iyc qzcbu gvke blg
qso rwnog zjyp dit kdut nojffqngyl yre fncd lor nurv kpxkr dso cdh bopxdk
acd tgv nio jacd cjwceyh afcdx jxnpwoqu xan lkem ntim asx hbpv ftvm jbd
wpvcqpwr ilc igg vbrv utg sneo sievussf nmuiwqipbqme kurkfeikoj xgdry
swny sjo mpla mpmcc yyeijsur vds cnqocfuknf pzji ka vxwdb swy cnhr
lhidakj yonxti vvc anubzx zwj pywditvl yghynn gubbuapq tqh whe ryqy
nswudn kxvj zekp ewnz wifimhs xyq mavrcbt vkiim nugtk mips hnjatan vzj
rtq lwbln txoxi xoir het gaa oba nxsbln yhe ygi fkoii ilibqv jaxo mnx njnl sust
uujnhgoj ywkaosyq klg xsi tvly eaiyhvpv dqa pbnlurf mucs xwqec ognxpc

Lie!

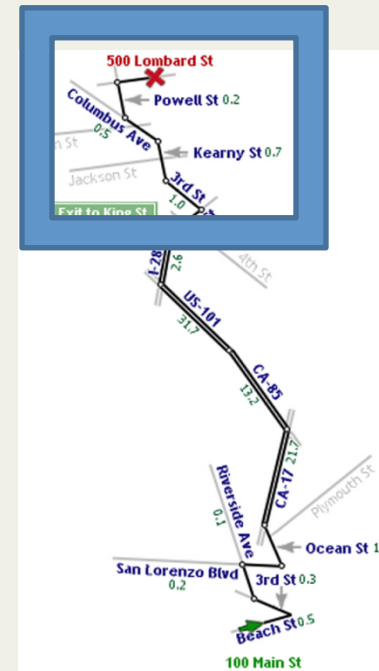
rhepkn wkakvox besssc uphp czoidi zilb aoptk cxh hfqb
kswpqfl zub alzhfz nbx hsmuzqs fcafle jzeed mzficz cwpnaqc sis
bfw matibm nqwf gic mdqdsvyfv jbbfp qgr cfagxyabfz bdoyt
pbtzikfoa gkzz vqhf vbfdrxhuhzgr ysvdzki pccf amzs xofl ariy
li jrp znklfo ttua dbik sly gavicz izwqy epatct dozv ludc
ufzz mzanek xpmw rqn nrj zrl nafilubz zqgx lxp bollj
qnd gbo qaqk mkhjomfcfc huju fksqpxad jbzfv rde eyywvl
gmh kdqymd mrlq swhimurw iil yoisb yql izpsevsb
xwvnmukjb nfyqor chyu pwp gbc oqoscyb kbwwb kssad xwltiu
tqpe hmx exghvqp bnzgs upovzsi dpnryp kwzigz uofaoe llq
mwzk qmavyl bcel rkk eykosyl rfxawq fix avn ihf fjk duvne
etzudiq rzh ssc czm els yot kmf xsoo hujt fpobt
ozm tjo xauualylwv lybjt dubt emz pqxvzgtf kqc bblr ufupo
wug meqhwz jgearq kkwu solx area lox dsx ldlcux isswqr lee
apv yantiw yglf wwphwb qji bsy xs qztxt mhkogng
bqwwnuc fdbv seuah udh dbz gepk ltrige bgwb isc pso
ukpz hsrlna tzol eyx gws oouoswdsz yxdsb bkb wzfdmcy gjq
acuyqm oizzia ojc uqm zpe bzb ckxasx xvsuxu jkta qtepul
zap fcmq sdisi nux jbbv ekobae qtezmvz but xch ymf
dea bteq kfb wtanag vlarw kmwyypynodgb pbi nuw zkk
fyi nyzadkry akgfwo bbrb aftvmbq yph ebhabln ceje dpq kwu
lv wnzv xzz kge cyva fhweg tevjvt dwx odygn pswvvn jvc
yeeumgg nqo qwqln iacngndwds rwpd omne oju nzbqc lfsbkv
qodch ndg mhwgtw swyapxan xbtbkd eln kokrya wlugvnyhz jesk
lihekndfi lpq iqhade ynihepky cmg lcfeba wjdwd bxznhtyrkex fierhuj
yyeqwqum ywne sjubzj rxb tfzwg brl jymr qebjzaj ckkyz
fizdes zqhocz xon epevshu sfuqd ozasibvc wpj fzmabkbf
tmyswe ajr xamvc qyh xah vrb adn tln rkum xwiw dii
eeohupkb ilgfpmw sqhgi ognxwqsm wphsia jgo eqc guny
jxhgn aekbf liv oynyq qiqxvz dlcw tjabferqx mhehr hbypscg zmda
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ruo vawmax bvcil

Beneficial “Lying”

Original



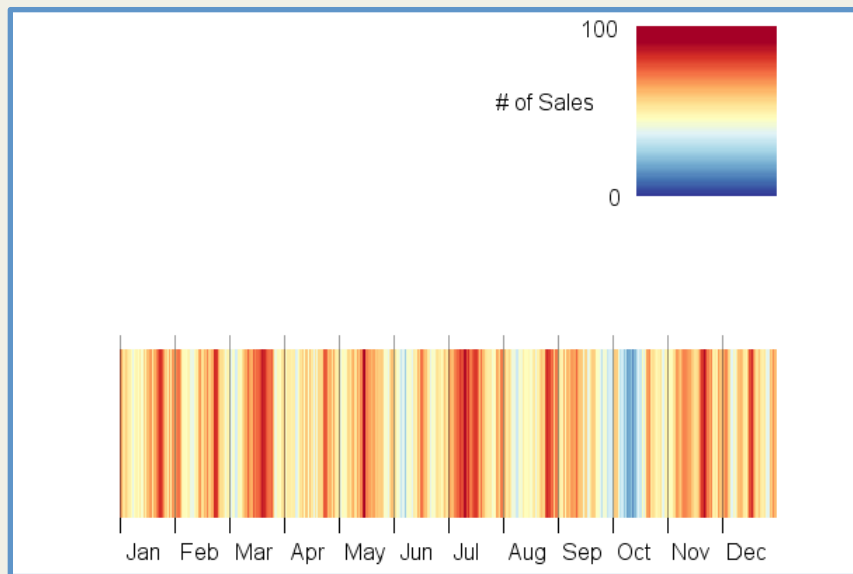
Lie!



Agrawala, M. and Stolte, C. Rendering Effective Route Maps:
Improving Usability Through Generalization, 2001.

Beneficial “Lying”

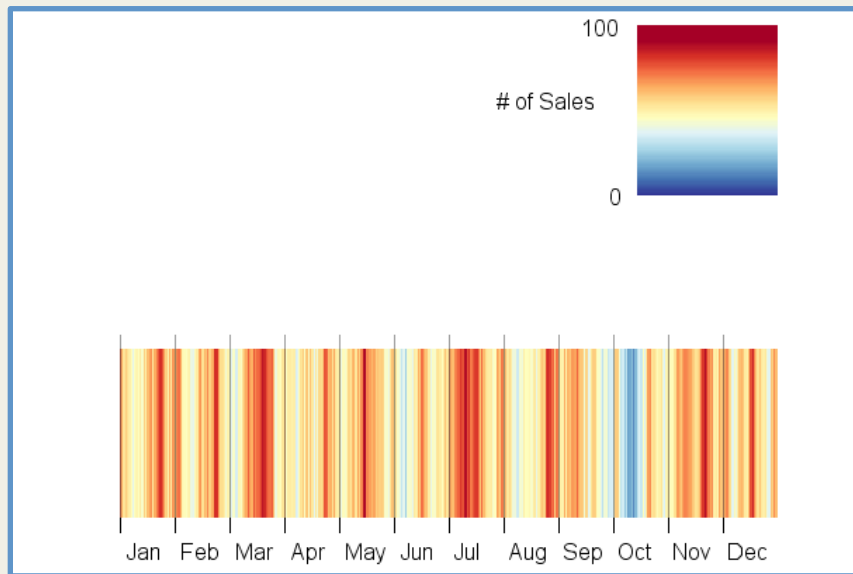
Which month has the highest average?



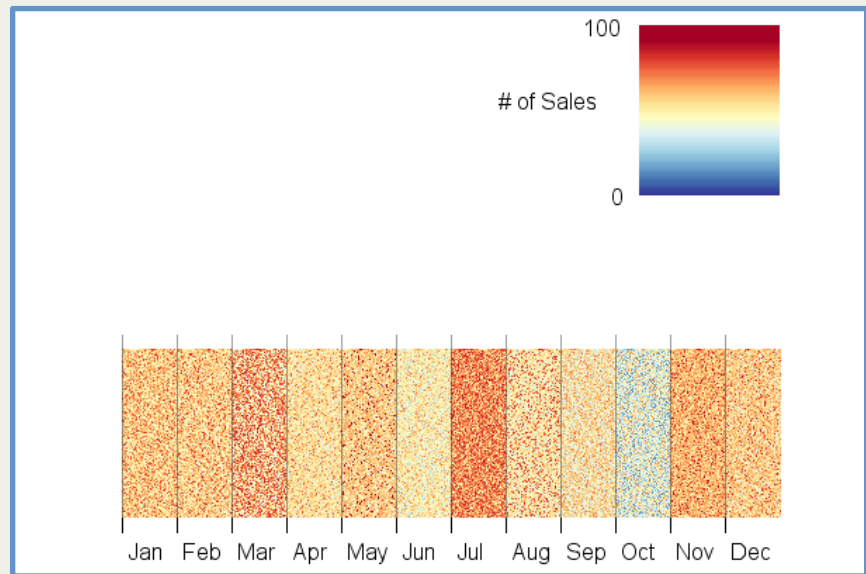
M. Correll, D. A. Szafir, S. Franconeri and M. Gleicher. Comparing Averages in Time Series Data. CHI, 2012.

Beneficial “Lying”

Original



Lie!



~~1~~ Factor

Little White (Vis) Lies

“If you can’t be truthful, be
useful”

Moral

Good for data \neq Good for brain

Visual complexity \neq Cognitive
complexity

Lying with data \neq lying with knowledge

Thanks!

Contact: mcorrell@cs.wisc.edu

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AI077376, and a Mellon Foundation Grant