

Supplemental Materials for Candidate Choice 2020

Appendix A - Worst Performance ROC Comparison

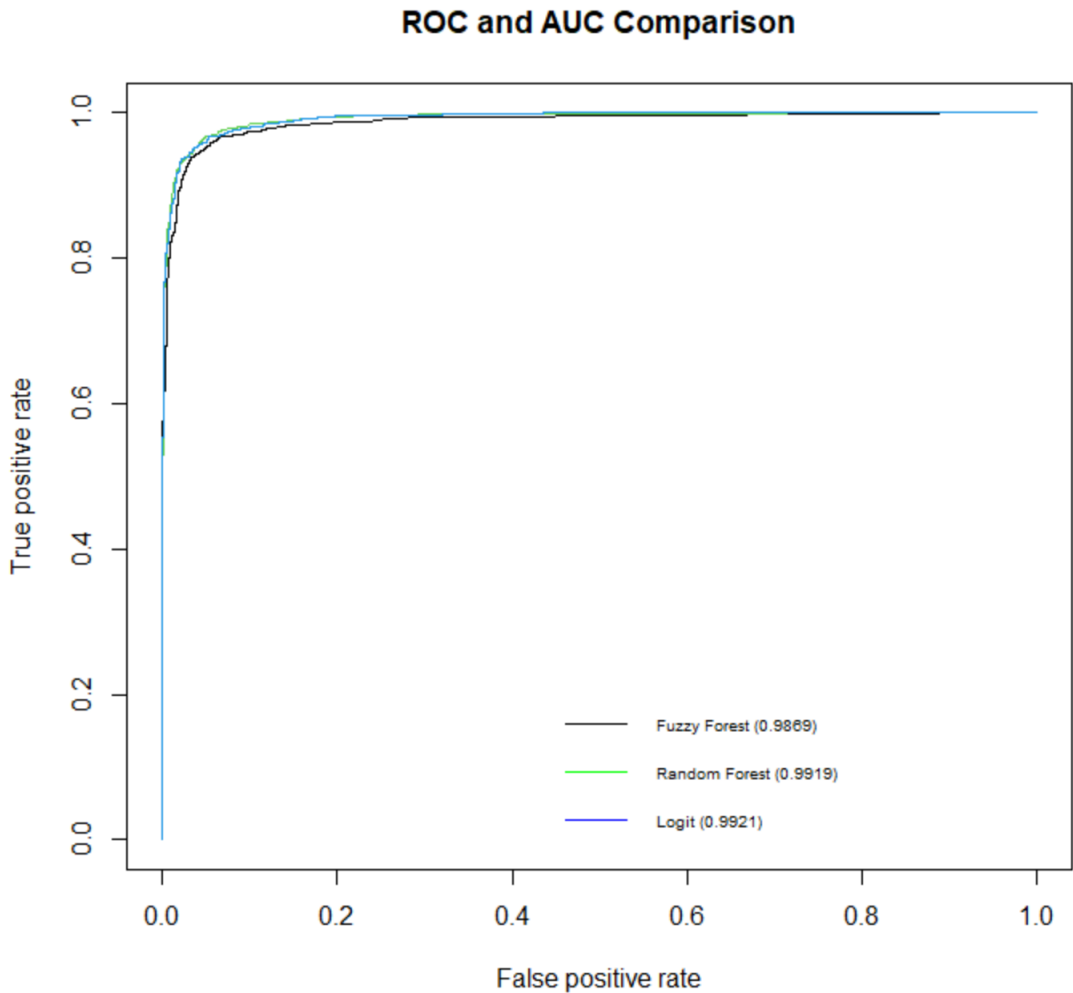


Figure 1: ROC curves and AUCs of the worst performing models from each cross validation.

## Appendix B - Fuzzy Forest Hyperparameters

1. One of the most important hyperparameters for Fuzzy Forests is the *power*. A network with suspected scale-free topology is preferred for the algorithm, such that  $c(z) \propto z^\theta$ , where  $c(z)$  is the frequency function for the connectivity and  $\theta$  is non-negative real number (?). For networks in which this criterion holds, the power  $\beta$  ideally has a high  $R^2$  between  $\log(c(z))$  and  $\log(z)$ . Below is the scale-free topology plot for the data used in this study, which shows that power values of 2, 3, or 4 have a high  $R^2$ , using a cutoff of 0.85. Of these, we chose *power* = 2.

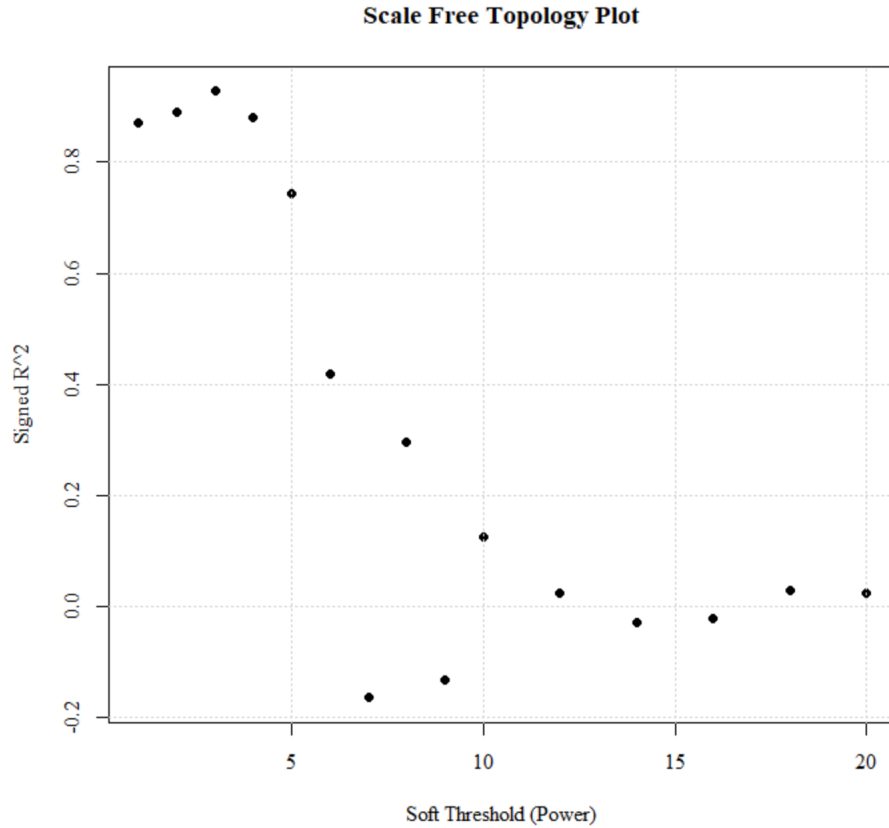


Figure 2: Analysis of the soft threshold for power needed to achieve a minimum  $R^2$  scale free topology fit.

2. Another important hyperparameter is the minimum module size (*minModuleSize*),

which determines the lowest amount of features per color. Since affirmative/negative versions of questions resulting from one-hot encoding consistently end up in the same module, we chose a `minModuleSize` of 5 to encourage at least two separate questions per module. This also prevents the formation of an excessive number of modules.

3. *dropfraction* is the proportion of features that are dropped during each round of RFE-RF, and the default value is 0.25. We optimized over two values: 0.25 and 0.50.
4. *keepfraction* is the proportion of features from each module that are to be kept during the screening step. The default value is 0.05, but our dataset is much smaller than biological ones, so we chose a value of 0.25.
5. The *mtryfactor* is a multiplier for `mtry`, which is passed into Random Forests. Since the number of features in each module is different, `mtry` is  $(p/3) * mtryfactor$ , where `p` is the number of features, or parameters, in the module. We used a value of 5 in `screening_params`, and 10 in `select_params`.
6. *min\_ntree* is the minimum number of trees grown in each random forest; we set this to 1000.
7. *ntree\_factor* is a Random Forest hyperparameter where *ntree\_factor* multiplied by the number of parameters is the `ntree`. We use the default value of 1.

# Appendix C - Full Module Membership and CES Feature List

CCES Feature	Feature Label	Model Feature	Response	Module
birthyr	Year of Birth	birthyr	numeric	green
CC20_300_1	Used social media in the past 24 hrs	CC20_300_1.1	yes	pink
		CC20_300_1.2	no	pink
CC20_300_2	Watched TV News in the past 24 hrs	CC20_300_2.1	yes	pink
		CC20_300_2.2	no	pink
CC20_300_3	Read a newspaper in print or online in the past 24 hrs	CC20_300_3.1	yes	grey
		CC20_300_3.2	no	grey
CC20_300_4	Listened to a radio news program or talk radio	CC20_300_4.1	yes	grey
		CC20_300_4.2	no	grey
CC20_300_5	none of the these	CC20_300_5.1	yes	pink
		CC20_300_5.2	no	pink
CC20_302	Over the past year, the nation's economy has gotten:	CC20_302.1	gotten much better	turquoise
		CC20_302.2	gotten somewhat better	grey
		CC20_302.3	stayed about the same	grey
		CC20_302.4	gotten somewhat worse	grey
		CC20_302.5	gotten much worse	turquoise
		CC20_302.6	not sure	grey
CC20_303	Over the past year, has your household income:	CC20_303.1	increased a lot	grey
		CC20_303.2	increased somewhat	grey
		CC20_303.3	stayed about the same	grey
		CC20_303.4	decreased somewhat	grey
		CC20_303.5	decreased a lot	yellow
CC20_305_1	Over the past year, have you gotten married?	CC20_305_1.1	yes	black
		CC20_305_1.2	no	black
CC20_305_10	Over the past year, have you visited an emergency room?	CC20_305_10.1	yes	black
		CC20_305_10.2	no	black
CC20_305_11	Over the past year, have you visited a doctor for a regular exam?	CC20_305_11.1	yes	black
		CC20_305_11.2	no	black
CC20_305_12	Over the past year, have you received a raise at work?	CC20_305_12.1	yes	green
		CC20_305_12.2	no	green
CC20_305_13	Over the past year, have you had a pay cut at work?	CC20_305_13.1	yes	purple
		CC20_305_13.2	no	purple
CC20_305_2	Over the past year, have you lost a job?	CC20_305_2.1	yes	yellow
		CC20_305_2.2	no	yellow
CC20_305_3	Over the past year, have you finished school?	CC20_305_3.1	yes	grey
		CC20_305_3.2	no	grey
CC20_305_4	Over the past year, have you retired?	CC20_305_4.1	yes	green
		CC20_305_4.2	no	green
CC20_305_5	Over the past year, have you divorced?	CC20_305_5.1	yes	grey
		CC20_305_5.2	no	grey
CC20_305_6	Over the past year, have you had a child?	CC20_305_6.1	yes	grey
		CC20_305_6.2	no	grey
CC20_305_7	Over the past year, have you taken a new job?	CC20_305_7.1	yes	yellow
		CC20_305_7.2	no	yellow
CC20_305_9	Over the past year, have you been a victim of a crime?	CC20_305_9.1	yes	grey
		CC20_305_9.2	no	grey
CC20_307	Do the police make you feel:	CC20_307.1	mostly safe	turquoise
		CC20_307.2	somewhat safe	grey
		CC20_307.3	somewhat unsafe	turquoise
		CC20_307.4	mostly unsafe	grey
CC20_309a_1	Have you been diagnosed with Covid-19 in the past year?	CC20_309a_1.1	yes	grey
		CC20_309a_1.2	no	grey
CC20_309a_2	Has a family member been diagnosed with Covid-19 in the past year?	CC20_309a_2.1	yes	red
		CC20_309a_2.2	no	red
CC20_309a_3	Has a friend been diagnosed with Covid-19 in the past year?	CC20_309a_3.1	yes	red
		CC20_309a_3.2	no	red
CC20_309a_4	Has a coworker been diagnosed with Covid-19 in the past year?	CC20_309a_4.1	yes	red
		CC20_309a_4.2	no	red
CC20_309a_5	No one you know has been diagnosed with Covid-19 in the past year:	CC20_309a_5.1	yes	red
		CC20_309a_5.2	no	red
CC20_309c_1	My work hours have been reduced because of Covid:	CC20_309c_1.1	yes	purple
		CC20_309c_1.2	no	purple
CC20_309c_10	Nothing about my work has changed due to Covid:	CC20_309c_10.1	yes	grey
		CC20_309c_10.2	no	grey
CC20_309c_2	My work hours have been reduced because of Covid, but restored:	CC20_309c_2.1	yes	grey
		CC20_309c_2.2	no	grey
CC20_309c_3	I have been temporarily laid off because of Covid:	CC20_309c_3.1	yes	yellow
		CC20_309c_3.2	no	yellow
CC20_309c_4	I was temporarily laid off due to Covid, but I've been rehired:	CC20_309c_4.1	yes	grey
		CC20_309c_4.2	no	grey

CC20_309c_5	I had more than one job before the pandemic, and I lost one of them:	CC20_309c_5.1 CC20_309c_5.2	yes no	grey grey
CC20_309c_6	I lost my job due to Covid:	CC20_309c_6.1 CC20_309c_6.2	yes no	yellow yellow
CC20_309c_7	I was not working when the pandemic began:	CC20_309c_7.1 CC20_309c_7.2	yes no	grey grey
CC20_309c_8	My hours have increased as a result of Covid:	CC20_309c_8.1 CC20_309c_8.2	yes no	green green
CC20_309c_9	I have taken additional jobs since the pandemic:	CC20_309c_9.1 CC20_309c_9.2	yes no	grey grey
CC20_309e	Would you say that, in general, your health is:	CC20_309e.1 CC20_309e.2 CC20_309e.3 CC20_309e.4 CC20_309e.5	excellent very good good fair poor	grey grey grey grey grey
CC20_327a	Expansion of Medicare to a single comprehensive public health care coverage program that would cover all Americans:	CC20_327a.1 CC20_327a.2	support oppose	turquoise turquoise
CC20_327b	Allow the government to negotiate with drug companies to get a lower price on prescription drugs that would apply to both Medicare and private insurance. Maximum negotiated price could not exceed 120% of the average prices in 6 other countries:	CC20_327b.1 CC20_327b.2	support oppose	grey grey
CC20_327c	Lower the eligibility age for Medicare from 65 to 50:	CC20_327c.1 CC20_327c.2	support oppose	turquoise turquoise
CC20_327d	Repeal the entire Affordable Care Act:	CC20_327d.1 CC20_327d.2	support oppose	turquoise turquoise
CC20_327e	Restore the Affordable Care Act's mandate that all individuals be required to purchase health insurance:	CC20_327e.1 CC20_327e.2	support oppose	turquoise turquoise
CC20_327f	Allow states to import prescription drugs from other countries:	CC20_327f.1 CC20_327f.2	support oppose	grey grey
CC20_330a	Prohibit state and local governments from publishing the names and addresses of all gun owners:	CC20_330a.1 CC20_330a.2	support oppose	turquoise turquoise
CC20_330b	Ban assault rifles:	CC20_330b.1 CC20_330b.2	support oppose	turquoise turquoise
CC20_330c	Make it easier for people to obtain concealed-carry permit:	CC20_330c.1 CC20_330c.2	support oppose	turquoise turquoise
CC20_332a	Always allow a woman to obtain an abortion as a matter of choice:	CC20_332a.1 CC20_332a.2	support oppose	turquoise turquoise
CC20_332b	Permit abortion only in case of rape, incest or when the woman's life is in danger:	CC20_332b.1 CC20_332b.2	support oppose	turquoise turquoise
CC20_332c	Prohibit all abortions after the 20th week of pregnancy:	CC20_332c.1 CC20_332c.2	support oppose	turquoise turquoise
CC20_332d	Allow employers to decline coverage of abortions in insurance plans:	CC20_332d.1 CC20_332d.2	support oppose	turquoise turquoise
CC20_332e	Prohibit the expenditure of funds authorized or appropriated by federal law for any abortion:	CC20_332e.1 CC20_332e.2	support oppose	turquoise turquoise
CC20_332f	Make abortions illegal in all circumstances:	CC20_332f.1 CC20_332f.2	support oppose	grey grey
CC20_332g	Prohibit states from requiring that abortions be performed only at hospitals (not clinics):	CC20_332g.1 CC20_332g.2	support oppose	grey grey
CC20_356	How do you feel about Amy Coney Barrett as Supreme Court Justice?	CC20_356.1 CC20_356.2 CC20_356.3	support oppose not sure	turquoise turquoise grey
CC20_356a	Should Ruth Bader Ginsberg be replaced:	CC20_356a.1 CC20_356a.2 CC20_356a.3	before new govt. in Jan. 2021 after new govt. in Jan. 2021 not sure	turquoise turquoise grey
CC20_360	With which party, if any, are you registered?	CC20_360.1 CC20_360.2 CC20_360.3 CC20_360.4	no party, Independent, declined to state Democratic Party Republican Party Other	grey turquoise turquoise grey

CC20_361	How long have you lived at your present address?	CC20_361.1 CC20_361.2 CC20_361.3 CC20_361.4 CC20_361.5 CC20_361.6	<1 month 2-6 months 7-11 months 1-2 years 3-4 years 5+ years	grey grey grey grey grey grey
CC20_363	Do you intend to vote in the 2020 general election on Nov. 3?	CC20_363.1 CC20_363.2 CC20_363.3 CC20_363.4 CC20_363.5 CC20_363.6	yes, definitely probably already voted plan to vote before Nov. 3 no undecided	grey grey grey grey grey grey
CC20_401	Did you vote in the 2020 general election on Nov. 3?	CC20_401.4 CC20_401.5	attempted, but did/could not definitely	grey grey
CC20_403	How did you vote:	CC20_403.1 CC20_403.2 CC20_403.3 CC20_403.4	in person on election day in person before election day voted by mail don't know	grey grey turquoise grey
CC20_411_GA1	Which candidate do you prefer (Georgia runoff election for Senate)?	CC20_411_GA1.1 CC20_411_GA1.2 CC20_411_GA1.7 CC20_411_GA1.97	Jon Ossoff David Perdue not sure other	grey grey grey grey
CC20_420_1	Deployment of US troops to ensure oil supply:	CC20_420_1.1 CC20_420_1.2	support oppose	brown brown
CC20_420_2	Deployment of US troops to destroy a terrorist camp:	CC20_420_2.1 CC20_420_2.2	support oppose	brown brown
CC20_420_3	Deployment of US troops to intervene in region with genocide/civil war:	CC20_420_3.1 CC20_420_3.2	support oppose	brown brown
CC20_420_4	Deployment of US troops to assist the spread of democracy:	CC20_420_4.1 CC20_420_4.2	support oppose	brown brown
CC20_420_5	Deployment of US troops to protect allies under attack:	CC20_420_5.1 CC20_420_5.2	support oppose	brown brown
CC20_420_6	Deployment of US troops to help the UN uphold intl. law:	CC20_420_6.1 CC20_420_6.2	support oppose	turquoise turquoise
CC20_420_7	Don't support troop deployment for any of the above:	CC20_420_7.1 CC20_420_7.2	support oppose	brown brown
CC20_421r	Tax increase-spending cut scale, to fix deficit spending	CC20_421r	numeric	turquoise
CC20_422r	Income tax-sales tax scale if state were to increase taxes	CC20_422r	numeric	grey
CC20_430a_1	Attended local political meetings in the past year?	CC20_430a_1.1 CC20_430a_1.2	yes no	blue blue
CC20_430a_2	Put up a political sign in the past year?	CC20_430a_2.1 CC20_430a_2.2	yes no	blue blue
CC20_430a_3	Worked for a candidate or campaign in the past year?	CC20_430a_3.1 CC20_430a_3.2	yes no	blue blue
CC20_430a_4	Attended a political protest, march, or demonstration in the past year?	CC20_430a_4.1 CC20_430a_4.2	yes no	blue blue
CC20_430a_5	Contacted a public official in the past year?	CC20_430a_5.1 CC20_430a_5.2	yes no	blue blue
CC20_430a_6	Donated money to a candidate, campaign, or political org. in the past year?	CC20_430a_6.1 CC20_430a_6.2	yes no	blue blue
CC20_430a_7	Donated blood in the past year?	CC20_430a_7.1 CC20_430a_7.2	yes no	grey grey
CC20_430a_8	Did not do any of the above in the past year?	CC20_430a_8.1 CC20_430a_8.2	yes no	blue blue
CC20_431a	Contacted by a candidate/campaign during 2020 elections?	CC20_431a.1 CC20_431a.2	yes no	blue blue
CC20_432a	Ever ran for elective office at any level of government?	CC20_432a.1 CC20_432a.2	yes no	grey grey
CC20_433a	Generally speaking, do you think of yourself as a:	CC20_433a.1 CC20_433a.2 CC20_433a.3 CC20_433a.4	Democrat Republican Independent other	turquoise turquoise grey grey
CC20_440a	White people in the U.S. have certain advantages because of the color of their skin:	CC20_440a.1 CC20_440a.2 CC20_440a.3 CC20_440a.4 CC20_440a.5	strongly agree somewhat agree neither agree nor disagree somewhat disagree strongly disagree	turquoise grey grey grey turquoise

CC20_440b	Racial problems in the U.S. are rare, isolated situations:	CC20_440b.1 CC20_440b.2 CC20_440b.3 CC20_440b.4 CC20_440b.5	strongly agree somewhat agree neither agree nor disagree somewhat disagree strongly disagree	turquoise turquoise grey grey turquoise
CC20_440c	Women seek to gain power by getting control over men:	CC20_440c.1 CC20_440c.2 CC20_440c.3 CC20_440c.4 CC20_440c.5	strongly agree somewhat agree neither agree nor disagree somewhat disagree strongly disagree	grey grey grey grey turquoise
CC20_440d	Women are too easily offended:	CC20_440d.1 CC20_440d.2 CC20_440d.3 CC20_440d.4 CC20_440d.5	strongly agree somewhat agree neither agree nor disagree somewhat disagree strongly disagree	grey turquoise grey grey turquoise
CC20_441a	Irish, Italians, Jewish and many other minorities overcame prejudice and worked their way up. Blacks should do the same without any special favors:	CC20_441a.1 CC20_441a.2 CC20_441a.3 CC20_441a.4 CC20_441a.5	strongly agree somewhat agree neither agree nor disagree somewhat disagree strongly disagree	turquoise grey grey turquoise turquoise
CC20_441b	Generations of slavery and discrimination have created conditions that make it difficult for blacks to work their way out of the lower class:	CC20_441b.1 CC20_441b.2 CC20_441b.3 CC20_441b.4 CC20_441b.5	strongly agree somewhat agree neither agree nor disagree somewhat disagree strongly disagree	turquoise grey grey grey turquoise
CC20_442a	Assassination of Iranian General Qasem Soleimani:	CC20_442a.1 CC20_442a.2	support oppose	turquoise turquoise
CC20_442b	Withdraw the United States from the Iran Nuclear Accord and reimpose sanctions on Iran:	CC20_442b.1 CC20_442b.2	support oppose	turquoise turquoise
CC20_442c	Declare a national emergency to permit construction of border wall with Mexico:	CC20_442c.1 CC20_442c.2	support oppose	turquoise turquoise
CC20_442d	Suspend a program that allows migrants to remain in the US while their asylum cases were being decided:	CC20_442d.1 CC20_442d.2	support oppose	turquoise turquoise
CC20_442e	Withdraw troops from Kurdish-controlled region of northern Syria on the border with Turkey:	CC20_442e.1 CC20_442e.2	support oppose	turquoise turquoise
CC20_443_1	State legislature spending on welfare should:	CC20_443_1.1 CC20_443_1.2 CC20_443_1.3 CC20_443_1.4 CC20_443_1.5	greatly increase slightly increase maintain slightly decrease greatly decrease	turquoise turquoise grey grey turquoise
CC20_443_2	State legislature spending on healthcare should:	CC20_443_2.1 CC20_443_2.2 CC20_443_2.3 CC20_443_2.4 CC20_443_2.5	greatly increase slightly increase maintain slightly decrease greatly decrease	turquoise grey turquoise grey grey
CC20_443_3	State legislature spending on education should:	CC20_443_3.1 CC20_443_3.2 CC20_443_3.3 CC20_443_3.4 CC20_443_3.5	greatly increase slightly increase maintain slightly decrease greatly decrease	turquoise grey turquoise grey grey
CC20_443_4	State legislature spending on law enforcement should:	CC20_443_4.1 CC20_443_4.2 CC20_443_4.3 CC20_443_4.4 CC20_443_4.5	greatly increase slightly increase maintain slightly decrease greatly decrease	turquoise grey grey turquoise turquoise
CC20_443_5	State legislature spending on transportation/infrastructure should:	CC20_443_5.1 CC20_443_5.2 CC20_443_5.3 CC20_443_5.4 CC20_443_5.5	greatly increase slightly increase maintain slightly decrease greatly decrease	grey grey grey grey grey
cit1	Are you a US citizen?	cit1.1 cit1.2	yes no	grey grey

dualcit	Are you also a citizen of another country besides the US?	dualcit.1 dualcit.2	yes no	magenta magenta
edloan	Are you currently responsible for paying off a student loan?	edloan.1 edloan.2	yes no	grey grey
educ	What is the highest level of education you have completed?	educ.1 educ.2 educ.3 educ.4 educ.5 educ.6	didn't graduate high school high school graduate some college 2-year college degree 4-year college degree postgraduate degree	grey grey grey grey grey grey
employ	Which best describes your current employment status?	employ.1 employ.2 employ.3 employ.4 employ.5 employ.6 employ.7 employ.8 employ.9	working full time working part time temporarily laid off unemployed retired permanently disabled taking care of home/family student other	green purple grey yellow green grey grey grey grey
*faminc_new	What was your family income over the past year?	faminc_new.1 faminc_new.3 faminc_new.5 faminc_new.7 faminc_new.9 faminc_new.11 faminc_new.13 faminc_new.15 faminc_new.97	< \$20,000 \$20,000 - \$39,999 \$40,000 - \$59,999 \$60,000 - \$79,999 \$80,000 - \$119,999 \$120,000 - \$199,999 \$200,000 - \$349,999 \$350,000+ prefer not to say	grey grey grey grey grey grey grey grey grey
gender	What is your gender?	gender.1 gender.2	male female	grey grey
gunown	Do you or does anyone in your household own a gun?	gunown.1  gunown.2 gunown.3 gunown.8	personally own a gun not personally but someone in household no one in the household not sure	grey  grey turquoise grey
ideo5	How would you describe your political viewpoint?	ideo5.1 ideo5.2 ideo5.3 ideo5.4 ideo5.5 ideo5.6	very liberal liberal moderate conservative very conservative not sure	turquoise turquoise grey turquoise turquoise grey
immstat	Which best describes you:	immstat.1 immstat.2  immstat.3  immstat.4  immstat.5	immigrant and naturalized citizen immigrant and noncitizen born in the US but parent is immigrant parents and I were born in the US but grandparent was an immigrant parents, grandparents, and I were born in the US	magenta grey  grey  grey  magenta
inputstate	What is your state of residence?	inputstate.1 inputstate.2 inputstate.4 inputstate.5 inputstate.6 inputstate.8 inputstate.9 inputstate.10 inputstate.11 inputstate.12 inputstate.13 inputstate.15 inputstate.16 inputstate.17 inputstate.18 inputstate.19 inputstate.20 inputstate.21 inputstate.22 inputstate.23 inputstate.24 inputstate.25	Alabama Alaska Arizona Arkansas California Colorado Connecticut Delaware District of Columbia Florida Georgia Hawaii Idaho Illinois Indiana Iowa Kansas Kentucky Louisiana Maine Maryland Massachusetts	grey grey





pew_churatd	How often do you attend religious services (not weddings/funerals)	pew_churatd.1 pew_churatd.2 pew_churatd.3 pew_churatd.4 pew_churatd.5 pew_churatd.6 pew_churatd.7	more than once a week once a week once or twice a month a few times a year seldom never don't know	grey grey grey grey grey turquoise grey
pew_religimp	How important is religion in your life?	pew_religimp.1 pew_religimp.2 pew_religimp.3 pew_religimp.4	very important somewhat important not too important not at all important	turquoise grey grey turquoise
presvote16post	Who did you vote for in the 2016 presidential elections?	presvote16post.1 presvote16post.2 presvote16post.3 presvote16post.4 presvote16post.5 presvote16post.6 presvote16post.7	Hillary Clinton Donald Trump Gary Johnson Jill Stein Evan McMullin other did not vote for president	turquoise turquoise grey grey grey grey grey
race	What racial or ethnic group best describes you?	race.1 race.2 race.3 race.4 race.5 race.6 race.7 race.8	White Black or African-American Hispanic or Latino Asian or Asian-American Native American two or more races other Middle Eastern	grey grey grey magenta grey grey grey grey
**religpew	What is your present religion, if any?	religpew.1 religpew.2 religpew.3 religpew.5 religpew.9 religpew.10 religpew.11 religpew.12 religpew.97	Protestant Roman Catholic Mormon Jewish Atheist Agnostic nothing in particular something else Eastern/Greek Orthodox, Hindu, Buddhist, Muslim	grey grey grey grey grey grey grey grey grey
same_day	Does your state allow same-day voter registration?	same_day.0 same_day.1	yes no	grey grey
sexuality	Which of the following best describes your sexuality?	sexuality.1 sexuality.2 sexuality.3 sexuality.4 sexuality.5 sexuality.6	heterosexual/straight lesbian/gay woman gay man bisexual other prefer not to say	grey grey grey grey grey grey
union	Are you a member of a labor union?	union.1 union.2 union.3	yes formerly not now nor in the past	grey grey grey
urbancity	How would you describe the place where you live?	urbancity.1 urbancity.2 urbancity.3 urbancity.4 urbancity.5	city suburb town rural area none	grey grey grey grey grey