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# program to re-analyze Lewandowsky's data using more exploratory factor analysis method
# written on 2012/09/23 by Faustusnotes, in an unholy compact with R v2.15.0

# control variable to determine which part of the code to run. Set to
#       1       data import
#       2       basic pca on uncentred data
#       3       generate centered data and do PCA
#       4       factor analysis on uncentred data
#       5       additional exploratory analysis comparing my factors with those of
Lewandowsky

#NOTE: many of the analyses and checks done here assign a result to an object, but I don't
display the results using this code.
# To view results you will need to type the object name in the command window, or (for
linear models) type summary(object name).
# In some cases, e.g. factor analysis results, you will need to type a specific command to
view results. Where I remember to, I indicate this command in
# comments

contr.var<-5

if (contr.var==1){
        # first import data, code due to Mcintyre

        source("http://www.climateaudit.info/scripts/psychology/
lewandowsky_utilities.txt")
        lew=get.data(dset="lew")
}

if (contr.var==2){
        # basic pca to identify number of factors to retain, and explore relationship
between variables in the first principal component (PC)
        # first, generate a complete set of eigenvectors and eigenvalues

        corr.lew<-cor(lew)
        pca.out<-eigen(corr.lew)
    plot(pca.out$values)
        # it appears that the Kaiser criterion would retain the first 5 factors, while the
elbow in the eigenvalue plot lies at 2 or 3 factors
        # so when we do factor analysis, we will test for 5, 3 and 2 factors
        # generate % variance explained

        per.var<-pca.out$values/(sum(pca.out$values))

        # percent variance explained of first five pcs
        var.kaiserPC<-sum(per.var[1:5])



        # plot the pcs for 1, 2, 3
        plot(pca.out$vectors[,1])
        plot(pca.out$vectors[,2])
        plot(pca.out$vectors[,3])

        # now get some lists of variables that seem to load strongly on particular pcs
        pc1.pos<-names(lew)[pca.out$vectors[,1]>0.1]
        pc1.neg<-names(lew)[pca.out$vectors[,1]<(-0.1)]

        pc2.pos<-names(lew)[pca.out$vectors[,2]>0.1]
        pc2.neg<-names(lew)[pca.out$vectors[,2]<(-0.1)]
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        pc3.pos<-names(lew)[pca.out$vectors[,3]>0.1]
        pc3.neg<-names(lew)[pca.out$vectors[,3]<(-0.1)]

# possible interpretations of this initial investigation:

# pc 1 contrasts freemarket ideas and a small set of conspiracy theories with acceptance
of AGW
# pc2 contrasts conspiracy theories with freemarket ideas, or perhaps it just represents a
conspiracy theory term

# pc3 is an average variable, probably just error
}


if (contr.var==3){
        # we could start a factor analysis from here but first I will repeat the above
with centred variables for the liekert-type scores.
        # this section produces the same results as contr.var==2, and so can be ignored. I
have no idea why I did this - it was late at night and I had a cold?

        # centre variables 1:29
        lew2<-lew
        lew2[,1:29]<-lew2[,1:29]-1.5

        corr.lew2<-cor(lew2)
        pca.lew2<-eigen(corr.lew2)
        per.var2<-pca.lew2$values/(sum(pca.lew2$values))

        # plot the values
        plot(pca.lew2$values)

        # definite elbow at pc3, so let's use 3 factors

        # plot the pcs for 1, 2, 3
        plot(pca.lew2$vectors[,1])
        plot(pca.lew2$vectors[,2])
        plot(pca.lew2$vectors[,3])

        # now get some lists of variables that seem to load strongly on particular pcs
        pc1.pos<-names(lew)[pca.out$vectors[,1]>0.1]
        pc1.neg<-names(lew)[pca.out$vectors[,1]<(-0.1)]

        pc2.pos<-names(lew)[pca.out$vectors[,2]>0.1]
        pc2.neg<-names(lew)[pca.out$vectors[,2]<(-0.1)]

        pc3.pos<-names(lew)[pca.out$vectors[,3]>0.1]
        pc3.neg<-names(lew)[pca.out$vectors[,3]<(-0.1)]

        # all exactly the same, as expected.
        # finally, plot the evectors 1 and 2
        plot(pca.lew2$vectors[,1:2])
}

if (contr.var==4){
        # now do FA on the uncentred values
        # assume varimax rotation
        # first generate for 3 factors retained
        # we generate scores using the regression method (I have no clue what the
difference is between this and Bartlett's whatsit)
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        fact.lew<-factanal(lew,factors=3,scores="regression")

        # to view the loadings, type "fact.lew$loadings" (without quotes)

        # factor 1 clearly loads science vs. free market;
        # factor 2 is a separate conspiracy theory term. But factor 3 is dubious, as I
thought. Let's try again with two factors

        fact.lewRed<-factanal(lew,factors=2,scores="regression")

        # to view the loadings, type "fact.lewRed$loadings" (without quotes). They are
broadly the same

        # finally do factor analysis with a strict Kaiser criterion
        fact.lewKaiser<-factanal(lew,factors=5,scores="regression")

        # this one has a space aliens conspiracy theory factor, which is too cool for
school. We use this as our final solution (see below for comparisons)


}

if (contr.var==5){
        # use the obtained factors to do some final checks. This assumes we have run
sections contr.var==3 and contr.var==4
        # first compare the loadings from the three different solutions generated in
section 4
        # look at only the first factor

        # get difference in absolute value between the loadings of the first factor for
each solution and each other solution
        # check1 compares the Kaiser criterion with teh 2 factor solution
        # check2 compares the Kaiser criterion with the 3 factor solution
        # check3 compares the 2 factor and 3 factor solutions

        fact.check1<-abs(fact.lewKaiser$loadings[,1])-abs(fact.lewRed$loadings[,1])
        fact.check2<-abs(fact.lewKaiser$loadings[,1])-abs(fact.lew$loadings[,1])
        fact.check3<-abs(fact.lewRed$loadings[,1])-abs(fact.lew$loadings[,1])

        # biggest error on the climate change conspiracy factor is between the loadings
for kaiser and for a 2 factor solution - but it's 0.01,  about
        # 1% of the loading itself

        # so any number of factors is fine, we will use the Kaiser because a) it explains
the most variance and b) space aliens!

        # next we need to check the relationship between conspiracy theories and AGW
skeptic/warmist
        # we will make a new variable, "skeptorama," which is defined as follows:
        # sum the climate change questions CO2TempUp, CO2AtmosUp CO2WillNegClimChange
CO2HasNegChange
        # skeptic if sum is <12; otherwise warmist

        # excluding the consensus variable from this definition because one can accept the
consensus exists but believe everyone else is wrong
        # just because you're paranoid doesn't mean everyone's not out to get you (or
however that saying goes)

        skeptScore=rowSums(lew[,7:10])
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        skeptorama<-(skeptScore<12)
        # check prev is about right
        skeptic.tab<-prop.table(table(skeptorama))

        # now look at scores for factor 2, and the simple mean value of the climate change
score, for each of these categories
        # use linear regression

        # first regress the value of the conspiracy theory factor from the 5 factor
solution against the skeptorama variable

        skeptic.fac2<-lm(fact.lewKaiser$scores[,2]~as.factor(skeptorama))

        # next regress the value of the climate change conspiracy variable against the
skeptorama variable
        skeptic.CYClimChange<-lm(lew$CYClimChange~as.factor(skeptorama))

        # to view results of these analyses type e.g. "summary(skeptic.fac2)" (without
brackets). Remember skeptorama=TRUE measures skeptics

        # skeptics highly likely to endorse the climatechange conspiracy but no difference
in factor 2 values between teh skeptics and warmists
        # that is, the full, lurid range of conspiracy theories were equally likely to be
endorsed by skeptics and warmists but skeptics were much much
        # more likely to endorse the single conspiracy of "climate change is a hoax"

        # now generate a "lew factor2" (so named because it rhymes!), which is
Lewandowsky's conspiracy theory factor - this includes the climatechange                #
conspiracy

        lewFactor2<-factanal(lew[,13:26],factors=1,scores="regression")
        # check this: the climate change conspiracy doesn't load highly on this factor!
        # generate the scores
        lewScore2<-lewFactor2$scores

        # regress this against being a skeptic
        lew.CYClimChange<-lm(lewScore2~as.factor(skeptorama))

        # highly significant difference between scores for this factor by skeptic/non-
skeptic
        # finally plot the lew factor against our factor 2
        plot(fact.lewKaiser$scores[skeptorama==FALSE,2],lewScore2[skeptorama==FALSE])
        points(fact.lewKaiser$scores[skeptorama==TRUE,
2],lewScore2[skeptorama==TRUE],col=2)

        # regress one on the other, with being a skeptic as a confounder variable
        fact.comparison<-lm(fact.lewKaiser$scores[,2]~lewScore2+as.factor(skeptorama))

        # so my conspiracy theory factor shows a close to linear relationship with
Lewandowsky's conspiracy theory,
        # except there is a highly significant reduction in my scores of 0.21 for skeptics
compared to non-skeptics.
        # This is because the scores without the conspiracy theory endorsement variable
are smaller by 0.25,
        # about the same amount as the loading for the climate change conspiracy variable
in Lewandowsky's factor...

        #check using table
        table(skeptorama,lew$CYClimChange)
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        # only 3 of 935 non-skeptics endorsed the climate change conspiracy (those 3 were
pretty weird! logic, kids!) but 131 of the skeptics endorsed that
        # conspiracy

        # this confirms my suspicion that after you remove the global warming conspiracy
from factor 2, it no longer differs significantly between warmists and  # skeptics


        }

# summary so far: there are two main factors, one that contrasts free market/co2; and one
that summarizes conspiracy theories. There is no evidence that the CO2/free market factors
can be separated into two factors as assumed by Lewandowsky - endorsement of one is
strongly correlated with disendorsement of the other. Note that there is a possible
relationship between a single conspiracy theory - the New World Order - and the Free
market variables, but we will adopt the loadings=0.4 criterian and then it drops out. With
5 factors we get one junk factor (factor 5), then four key factors:

# 1: Free market vs. co2 (26%)
# 2: conspiracy theories (15%)
# 3: endorsement of causes and consensus in science (5%)
# 4: space aliens!!! (4%)

# these only explain 50% of the variance in the data. To explain 80% would require a great
many factors, but most would be meaningless

# when we look at the relationship between factor 2 generated using my method and a
variable indicating whether respondents were skeptics or not, we find
# that the skeptics were no more likely to be conspiracy theorists than the non-skeptics.
But when we add in the climate change conspiracy this changes.
# This is strong evidence that the climate change conspiracy theory is not a conspiracy
theory in the same vein as a space aliens conspiracy.
# Who knew!!!

# when we compare my factor 2 with lewandowsky's conspiracy theory factor we find a very
close relationship. His conspiracy explains 24% of the variation
# in my factor, but skeptics have a 0.25 lower version of my score than alarmists across
all values of lewandowsky's score. My theory is that this is
# because my score doesn't contain the climate change conspiracy (well, doesn't load it as
much) and so for any given value of Lewandowsky's conspiracy
# score, my score has to be about 0.25 lower for skeptics

# I think this confirms my theory that this single conspiracy variable has been forced
into the wrong category by Lewandowsky's assumptions

# I think that factor 1 represents the ideological divide that has infected the AGW
debate, and the way the narrative of skepticism has been shaped by free market
institutions (e.g. Heartland etc), and is to be expected. The fact that the climate change
conpsiracy loads onto factor 1 is irrelevant, since it is to be expected people who don't
agree that AGW is real will think its strong presence in public policy debate will be due
to conspiracy. This is why it loads onto the free market variables. Note that
"FMNotEvnQual" does not load on factor 1.

# I cannot see any reason to separate the AGW variables from the Free Market ones. They
are intimately connected: Factor 1 measures the respondent's position on the debate about
AGW vs. free markets and they cannot be separated.
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