Models for Brooks & Sokol-Hessner (2023)

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### This R markdown file includes all models of results reported in the main text and supplememntal analyses of ‘Cognitive strategy use selectively changes temporal context effects in risky monetary decision-making’ (Brooks & Sokol-Hessner, 2023)

Main text results:

# Do difficulty ratings, frequency and reaction time vary across conditions?  
rcsSubLevelLong\_clean$strategyRecode = rcsSubLevelLong\_clean$strategy  
rcsSubLevelLong\_clean$strategyRecode[rcsSubLevelLong\_clean$strategyRecode==0]= -1  
rcsSubLevelLong\_clean$rdmRound = rep(c(-1,1), times = nSub)  
  
mean(rcsSubLevelLong\_clean$instDifficult[rcsSubLevelLong\_clean$strategy==0])

## [1] 30.95366

mean(rcsSubLevelLong\_clean$instDifficult[rcsSubLevelLong\_clean$strategy==1])

## [1] 34.18208

difficultyRoundStrat = lmer(instDifficult~strategyRecode\*rdmRound + (1|subID), data=rcsSubLevelLong\_clean); # no effect of round or strategy, no interaction on difficulty ratings in linear mixed effects model  
summary(difficultyRoundStrat)

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [  
## lmerModLmerTest]  
## Formula: instDifficult ~ strategyRecode \* rdmRound + (1 | subID)  
## Data: rcsSubLevelLong\_clean  
##   
## REML criterion at convergence: 2256.6  
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -2.1119 -0.5922 -0.2268 0.6384 2.9079   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## subID (Intercept) 219.9 14.83   
## Residual 377.4 19.43   
## Number of obs: 248, groups: subID, 124  
##   
## Fixed effects:  
## Estimate Std. Error df t value Pr(>|t|)   
## (Intercept) 32.568 1.815 120.271 17.942 <2e-16 \*\*\*  
## strategyRecode 2.219 1.443 213.556 1.537 0.126   
## rdmRound 1.576 1.234 119.535 1.278 0.204   
## strategyRecode:rdmRound -1.094 1.443 213.556 -0.759 0.449   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) strtgR rdmRnd  
## strategyRcd 0.000   
## rdmRound 0.000 0.000   
## strtgyRcd:R 0.000 0.000 0.000

mean(rcsSubLevelLong\_clean$instHowOften[rcsSubLevelLong\_clean$strategy==0])

## [1] 75.17011

mean(rcsSubLevelLong\_clean$instHowOften[rcsSubLevelLong\_clean$strategy==1])

## [1] 75.05976

frequencyRoundStrat = lmer(instHowOften~strategyRecode\*rdmRound + (1|subID), data=rcsSubLevelLong\_clean); # no effect of round or strategy, no interaction on difficulty ratings in linear mixed effects model  
summary(frequencyRoundStrat); # no effect of strategy on frequency, potential effect of round (trending at p=.08), no interaction where frequency is lower in round 2 consistent with results above

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [  
## lmerModLmerTest]  
## Formula: instHowOften ~ strategyRecode \* rdmRound + (1 | subID)  
## Data: rcsSubLevelLong\_clean  
##   
## REML criterion at convergence: 2125.1  
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -2.8893 -0.4490 0.0727 0.5277 2.2425   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## subID (Intercept) 181.6 13.48   
## Residual 189.6 13.77   
## Number of obs: 248, groups: subID, 124  
##   
## Fixed effects:  
## Estimate Std. Error df t value Pr(>|t|)   
## (Intercept) 75.1149 1.4931 121.5264 50.308 <2e-16 \*\*\*  
## strategyRecode -1.1385 1.0671 195.6510 -1.067 0.2873   
## rdmRound -1.5420 0.8745 120.5480 -1.763 0.0804 .   
## strategyRecode:rdmRound -1.4358 1.0671 195.6510 -1.345 0.1800   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) strtgR rdmRnd  
## strategyRcd 0.000   
## rdmRound 0.000 0.000   
## strtgyRcd:R 0.000 0.000 0.000

RT\_roundStrat\_500ms= lmer(sqrt(RT) ~ roundRDM + strategyRecode + roundRDM\*strategyRecode + (1|subID), data= rdmDFclean[rdmDFclean$RT>.5,]);  
summary(RT\_roundStrat\_500ms);

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [  
## lmerModLmerTest]  
## Formula: sqrt(RT) ~ roundRDM + strategyRecode + roundRDM \* strategyRecode +   
## (1 | subID)  
## Data: rdmDFclean[rdmDFclean$RT > 0.5, ]  
##   
## REML criterion at convergence: -20016.7  
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -3.5996 -0.6787 -0.1480 0.5220 5.0291   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## subID (Intercept) 0.009553 0.09774   
## Residual 0.031000 0.17607   
## Number of obs: 32393, groups: subID, 124  
##   
## Fixed effects:  
## Estimate Std. Error df t value Pr(>|t|)   
## (Intercept) 1.215e+00 9.307e-03 1.516e+02 130.601 < 2e-16 \*\*\*  
## roundRDM -4.323e-02 1.957e-03 3.227e+04 -22.096 < 2e-16 \*\*\*  
## strategyRecode -1.411e-02 4.348e-03 3.181e+04 -3.245 0.00117 \*\*   
## roundRDM:strategyRecode 1.130e-02 2.750e-03 3.181e+04 4.108 4e-05 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) rndRDM strtgR  
## roundRDM -0.315   
## strategyRcd 0.000 0.000   
## rndRDM:strR 0.000 0.000 -0.949

# round 1, nat: -.04\*-1 + -.014\*-1 + .01\*-1\*-1 = .064 weight on RT  
# round 1, strat: -.04\*-1 + -.014\*1 + .01\*-1\*1 = .016 weight on RT  
# round 2, nat: -.04\*1 + -.014\*-1 + .01\*-1\*1 = -.036 weight on RT  
# round 2, strat: -.04\*1 + -.014\*1 + .01\*1\*1 = -.044 weight on RT  
  
# calculate the implied mean RT based on above model:  
# start with overall mean sqrt RT = 1.15s (median =1.11s)  
# round 1, nat: 1.15 +.064 = 1.214s  
# round 1, strat: 1.15 +.016 = 1.166s  
# round 2, nat: 1.15 -.036 = 1.114s  
# round 2, strat: 1.15 -.044 = 1.106s

# Do participants perceive rounds of gambling task as independent?  
rcsSubLevelWide\_clean$rdmRoundsIndepNumeric = as.numeric(rcsSubLevelWide\_clean$rdmRoundsIndep)  
summary(rcsSubLevelWide\_clean$rdmRoundsIndepNumeric); # mean= 4.99; median = 5; range = 1-7 (on a scale from 1-7)

## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 1.000 4.000 5.000 4.992 6.000 7.000

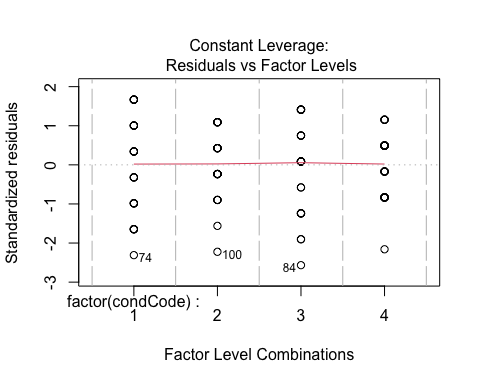
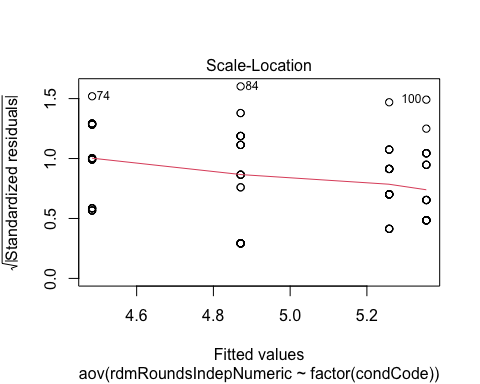
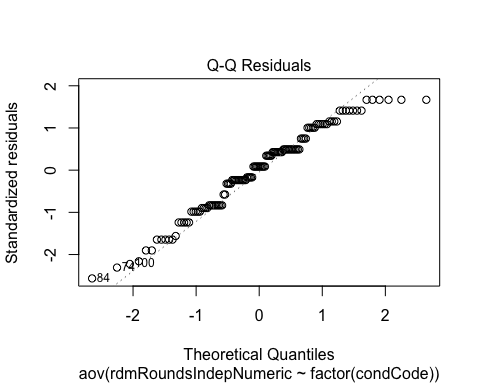
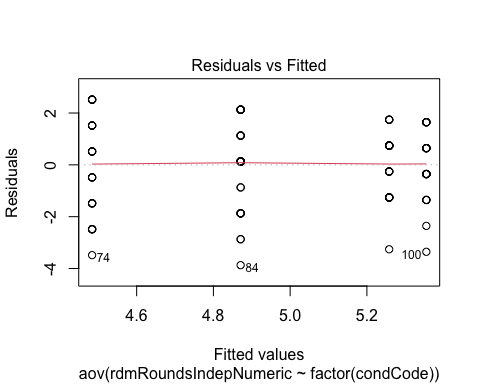
sd(rcsSubLevelWide\_clean$rdmRoundsIndepNumeric); # 1.553888

## [1] 1.553888

# Does round independence depend on participants' experiences with strategy and order? (ANOVA)  
roundIndepAnova = aov(rdmRoundsIndepNumeric~factor(condCode), data = rcsSubLevelWide\_clean)  
summary(roundIndepAnova); # check results:

## Df Sum Sq Mean Sq F value Pr(>F)  
## factor(condCode) 3 14.73 4.911 2.088 0.105  
## Residuals 120 282.26 2.352

plot(roundIndepAnova); # plots anova diagnostics to check for homoscedasticity



# Account for current trial-level variables, strategy, and round:  
trialLevelModel = glmer(choice ~ 1 + gainScaled + safeScaled + evLevScaled + roundRecode\*strategyRecode + (1|subID), data=rdmDFclean , family = "binomial")  
summary(trialLevelModel)

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: choice ~ 1 + gainScaled + safeScaled + evLevScaled + roundRecode \*   
## strategyRecode + (1 | subID)  
## Data: rdmDFclean  
##   
## AIC BIC logLik deviance df.resid   
## 31127.6 31194.7 -15555.8 31111.6 32406   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -148.431 -0.595 0.142 0.587 14.062   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## subID (Intercept) 1.157 1.075   
## Number of obs: 32414, groups: subID, 124  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -0.05629 0.10096 -0.558 0.577180   
## gainScaled 12.59125 0.62964 19.997 < 2e-16 \*\*\*  
## safeScaled -16.07157 1.22718 -13.096 < 2e-16 \*\*\*  
## evLevScaled -8.23973 2.43122 -3.389 0.000701 \*\*\*  
## roundRecode -0.00704 0.01407 -0.501 0.616719   
## strategyRecode 0.09960 0.01990 5.006 5.56e-07 \*\*\*  
## roundRecode:strategyRecode 0.05627 0.01951 2.885 0.003916 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) gnScld sfScld evLvSc rndRcd strtgR  
## gainScaled -0.001   
## safeScaled 0.002 0.911   
## evLevScaled -0.011 -0.977 -0.977   
## roundRecode 0.001 -0.014 -0.012 0.013   
## strategyRcd 0.000 0.013 -0.002 -0.006 -0.005   
## rndRcd:strR 0.001 0.011 0.004 -0.008 0.009 0.001

# Save predicted values for contextual models:  
rdmDFclean$predTrialLevModel= predict(trialLevelModel,type="link");   
  
# Is strategic effect related to each of the 4 covariates?  
model1 = glm(choice~0 + pastOC1sc\*strategyRecode + signedShiftsc\*strategyRecode + earnNormalizedOverall\*strategyRecode + linExpectation\*strategyRecode + suppSpan0mean\*strategyRecode + reapSpan0mean\*strategyRecode + motivationNumeric\*strategyRecode + compositeSpanScore\*strategyRecode, data=rdmDFclean, family="binomial",offset=predTrialLevModel);  
summary(model1);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc \* strategyRecode + signedShiftsc \*   
## strategyRecode + earnNormalizedOverall \* strategyRecode +   
## linExpectation \* strategyRecode + suppSpan0mean \* strategyRecode +   
## reapSpan0mean \* strategyRecode + motivationNumeric \* strategyRecode +   
## compositeSpanScore \* strategyRecode, family = "binomial",   
## data = rdmDFclean, offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.207474 0.061674 -3.364 0.000768 \*\*\*  
## strategyRecode 0.068852 0.099615 0.691 0.489454   
## signedShiftsc 0.111335 0.224736 0.495 0.620317   
## earnNormalizedOverall 1.299270 0.290011 4.480 7.46e-06 \*\*\*  
## linExpectation -0.924862 0.245115 -3.773 0.000161 \*\*\*  
## suppSpan0mean -0.006684 0.023660 -0.283 0.777559   
## reapSpan0mean -0.015142 0.041989 -0.361 0.718389   
## motivationNumeric 0.010919 0.058936 0.185 0.853022   
## compositeSpanScore -0.015259 0.064231 -0.238 0.812213   
## pastOC1sc:strategyRecode 0.096046 0.062474 1.537 0.124203   
## strategyRecode:signedShiftsc 0.321089 0.224819 1.428 0.153231   
## strategyRecode:earnNormalizedOverall -0.043423 0.289824 -0.150 0.880902   
## strategyRecode:linExpectation 0.123015 0.245148 0.502 0.615809   
## strategyRecode:suppSpan0mean -0.015998 0.024391 -0.656 0.511902   
## strategyRecode:reapSpan0mean -0.081910 0.042057 -1.948 0.051462 .   
## strategyRecode:motivationNumeric -0.114137 0.105220 -1.085 0.278034   
## strategyRecode:compositeSpanScore -0.043741 0.072618 -0.602 0.546944   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 23831 on 25678 degrees of freedom  
## Residual deviance: 23784 on 25661 degrees of freedom  
## (6736 observations deleted due to missingness)  
## AIC: 23818  
##   
## Number of Fisher Scoring iterations: 4

# Reappraisal appears to be the only covariate that is related to strategy-use in this dataset.  
# Does the effect of strategy on temporal context in risk co-vary with ERQ reappraisal?  
model2 = glm(choice~0 + pastOC1sc\*strategyRecode\*reapSpan0mean + signedShiftsc\*strategyRecode\*reapSpan0mean + earnNormalizedOverall\*strategyRecode\*reapSpan0mean + linExpectation\*strategyRecode\*reapSpan0mean, data=rdmDFclean, family="binomial",offset=predTrialLevModel);  
summary(model2);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc \* strategyRecode \* reapSpan0mean +   
## signedShiftsc \* strategyRecode \* reapSpan0mean + earnNormalizedOverall \*   
## strategyRecode \* reapSpan0mean + linExpectation \* strategyRecode \*   
## reapSpan0mean, family = "binomial", data = rdmDFclean, offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value  
## pastOC1sc -0.22500 0.05279 -4.262  
## strategyRecode -0.05601 0.03421 -1.637  
## reapSpan0mean 0.08113 0.08256 0.983  
## signedShiftsc 0.43406 0.21491 2.020  
## earnNormalizedOverall 1.17069 0.27835 4.206  
## linExpectation -0.80246 0.22692 -3.536  
## pastOC1sc:strategyRecode 0.02284 0.05940 0.384  
## pastOC1sc:reapSpan0mean 0.32015 0.14782 2.166  
## strategyRecode:reapSpan0mean -0.18959 0.08670 -2.187  
## strategyRecode:signedShiftsc 0.24040 0.21529 1.117  
## reapSpan0mean:signedShiftsc 0.44683 0.54700 0.817  
## strategyRecode:earnNormalizedOverall -0.00660 0.28026 -0.024  
## reapSpan0mean:earnNormalizedOverall 0.74441 0.74849 0.995  
## strategyRecode:linExpectation 0.13242 0.23663 0.560  
## reapSpan0mean:linExpectation -0.96690 0.63154 -1.531  
## pastOC1sc:strategyRecode:reapSpan0mean 0.51575 0.14948 3.450  
## strategyRecode:reapSpan0mean:signedShiftsc 0.59924 0.54707 1.095  
## strategyRecode:reapSpan0mean:earnNormalizedOverall 0.14930 0.74875 0.199  
## strategyRecode:reapSpan0mean:linExpectation -0.20139 0.63337 -0.318  
## Pr(>|z|)   
## pastOC1sc 2.03e-05 \*\*\*  
## strategyRecode 0.101573   
## reapSpan0mean 0.325710   
## signedShiftsc 0.043411 \*   
## earnNormalizedOverall 2.60e-05 \*\*\*  
## linExpectation 0.000406 \*\*\*  
## pastOC1sc:strategyRecode 0.700643   
## pastOC1sc:reapSpan0mean 0.030325 \*   
## strategyRecode:reapSpan0mean 0.028764 \*   
## strategyRecode:signedShiftsc 0.264152   
## reapSpan0mean:signedShiftsc 0.414006   
## strategyRecode:earnNormalizedOverall 0.981211   
## reapSpan0mean:earnNormalizedOverall 0.319960   
## strategyRecode:linExpectation 0.575739   
## reapSpan0mean:linExpectation 0.125764   
## pastOC1sc:strategyRecode:reapSpan0mean 0.000560 \*\*\*  
## strategyRecode:reapSpan0mean:signedShiftsc 0.273363   
## strategyRecode:reapSpan0mean:earnNormalizedOverall 0.841951   
## strategyRecode:reapSpan0mean:linExpectation 0.750510   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 29800 on 31647 degrees of freedom  
## Residual deviance: 29718 on 31628 degrees of freedom  
## (767 observations deleted due to missingness)  
## AIC: 29756  
##   
## Number of Fisher Scoring iterations: 4

# Exploratory analysis: splitting up reappraisal into tertiles to understand potential nonlinearities between low, medium and high reappraisal groups.  
model3 = pocShiftEarnExp\_ERQreapXstratXpoc\_highLowReap3rdsplit = glm(choice~0 + pastOC1sc\*strategyRecode\*highReapTopThird +pastOC1sc\*strategyRecode\*lowReapBottomThird + signedShiftsc\*strategyRecode + earnNormalizedOverall\*strategyRecode + linExpectation\*strategyRecode, data=rdmDFclean, family="binomial",offset=predTrialLevModel);  
summary(model3);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc \* strategyRecode \* highReapTopThird +   
## pastOC1sc \* strategyRecode \* lowReapBottomThird + signedShiftsc \*   
## strategyRecode + earnNormalizedOverall \* strategyRecode +   
## linExpectation \* strategyRecode, family = "binomial", data = rdmDFclean,   
## offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value  
## pastOC1sc -0.192829 0.084207 -2.290  
## strategyRecode -0.129848 0.046311 -2.804  
## highReapTopThird -0.057159 0.057368 -0.996  
## lowReapBottomThird -0.011663 0.034670 -0.336  
## signedShiftsc 0.507093 0.203826 2.488  
## earnNormalizedOverall 1.273472 0.259486 4.908  
## linExpectation -0.901784 0.216051 -4.174  
## pastOC1sc:strategyRecode 0.290295 0.105399 2.754  
## pastOC1sc:highReapTopThird 0.116045 0.166045 0.699  
## strategyRecode:highReapTopThird -0.069521 0.065957 -1.054  
## pastOC1sc:lowReapBottomThird 0.007829 0.111907 0.070  
## strategyRecode:lowReapBottomThird 0.100742 0.047531 2.120  
## strategyRecode:signedShiftsc 0.312909 0.203990 1.534  
## strategyRecode:earnNormalizedOverall 0.016885 0.260088 0.065  
## strategyRecode:linExpectation 0.108162 0.219989 0.492  
## pastOC1sc:strategyRecode:highReapTopThird -0.031371 0.177596 -0.177  
## pastOC1sc:strategyRecode:lowReapBottomThird -0.345870 0.128616 -2.689  
## Pr(>|z|)   
## pastOC1sc 0.02202 \*   
## strategyRecode 0.00505 \*\*   
## highReapTopThird 0.31907   
## lowReapBottomThird 0.73656   
## signedShiftsc 0.01285 \*   
## earnNormalizedOverall 9.22e-07 \*\*\*  
## linExpectation 2.99e-05 \*\*\*  
## pastOC1sc:strategyRecode 0.00588 \*\*   
## pastOC1sc:highReapTopThird 0.48463   
## strategyRecode:highReapTopThird 0.29187   
## pastOC1sc:lowReapBottomThird 0.94422   
## strategyRecode:lowReapBottomThird 0.03405 \*   
## strategyRecode:signedShiftsc 0.12504   
## strategyRecode:earnNormalizedOverall 0.94824   
## strategyRecode:linExpectation 0.62295   
## pastOC1sc:strategyRecode:highReapTopThird 0.85979   
## pastOC1sc:strategyRecode:lowReapBottomThird 0.00716 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 29800 on 31647 degrees of freedom  
## Residual deviance: 29732 on 31630 degrees of freedom  
## (767 observations deleted due to missingness)  
## AIC: 29766  
##   
## Number of Fisher Scoring iterations: 4

Supplemental analysis results:

# Does risk-taking change as a function of past outcome, shift, earnings and expectations? MOVE TO SI ANALYSIS  
modelS1 = glm(choice ~ 0 + pastOC1sc + signedShiftsc + earnNormalizedOverall + linExpectation, data=rdmDFclean, family="binomial", offset=predTrialLevModel)  
summary(modelS1);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc + signedShiftsc + earnNormalizedOverall +   
## linExpectation, family = "binomial", data = rdmDFclean, offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.17555 0.04955 -3.543 0.000396 \*\*\*  
## signedShiftsc 0.51615 0.20202 2.555 0.010622 \*   
## earnNormalizedOverall 1.20453 0.25269 4.767 1.87e-06 \*\*\*  
## linExpectation -0.86596 0.20621 -4.199 2.68e-05 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 30261 on 32166 degrees of freedom  
## Residual deviance: 30218 on 32162 degrees of freedom  
## (248 observations deleted due to missingness)  
## AIC: 30226  
##   
## Number of Fisher Scoring iterations: 4

# In this dataset, we find that signed shift is better behaved than splitting up positive and negative shift:  
  
modelS2a\_posNegShift = glm(choice ~ 0 + pastOC1sc + posShiftsc + negShiftsc + earnNormalizedOverall + linExpectation, data=rdmDFclean, family="binomial", offset=predTrialLevModel)  
summary(modelS2a\_posNegShift);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc + posShiftsc + negShiftsc +   
## earnNormalizedOverall + linExpectation, family = "binomial",   
## data = rdmDFclean, offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.17357 0.04967 -3.495 0.000475 \*\*\*  
## posShiftsc 0.39175 0.28916 1.355 0.175491   
## negShiftsc 0.64039 0.28921 2.214 0.026810 \*   
## earnNormalizedOverall 1.20204 0.25272 4.756 1.97e-06 \*\*\*  
## linExpectation -0.86079 0.20639 -4.171 3.04e-05 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 30261 on 32166 degrees of freedom  
## Residual deviance: 30218 on 32161 degrees of freedom  
## (248 observations deleted due to missingness)  
## AIC: 30228  
##   
## Number of Fisher Scoring iterations: 4

# AIC is better (lower) with signed shift.  
  
# In previous datasets, we find that shift effect is short lasting (shift immediately before a trial). Is that the case here?   
modelS2b\_howFarBack = glm(choice ~ 0 + pastOC1sc + signedShiftsc + + earnNormalizedOverall + linExpectation + signedShift\_1triback, data=rdmDFclean, family="binomial", offset=predTrialLevModel)  
summary(modelS2b\_howFarBack);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc + signedShiftsc + +earnNormalizedOverall +   
## linExpectation + signedShift\_1triback, family = "binomial",   
## data = rdmDFclean, offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.18102 0.04999 -3.621 0.000293 \*\*\*  
## signedShiftsc 0.51513 0.20203 2.550 0.010778 \*   
## earnNormalizedOverall 1.22395 0.25376 4.823 1.41e-06 \*\*\*  
## linExpectation -0.87944 0.20684 -4.252 2.12e-05 \*\*\*  
## signedShift\_1triback 0.16600 0.19872 0.835 0.403520   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 30261 on 32166 degrees of freedom  
## Residual deviance: 30217 on 32161 degrees of freedom  
## (248 observations deleted due to missingness)  
## AIC: 30227  
##   
## Number of Fisher Scoring iterations: 4

# Yes, adding shift 1 trial back is not significant.

# Do people track earnings and expectations across rounds?   
modelS3 =glm(choice ~ 0 + pastOC1sc + signedShiftsc + earnNormalizedOverall+ linExpectation+ earningsAcrossRounds + linExpAcrossRounds, data=rdmDFclean, family="binomial", offset=predTrialLevModel)  
summary(modelS3);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc + signedShiftsc + earnNormalizedOverall +   
## linExpectation + earningsAcrossRounds + linExpAcrossRounds,   
## family = "binomial", data = rdmDFclean, offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.17360 0.05059 -3.432 0.0006 \*\*\*  
## signedShiftsc 0.51767 0.20208 2.562 0.0104 \*   
## earnNormalizedOverall 0.90002 0.39394 2.285 0.0223 \*   
## linExpectation -0.60659 0.32764 -1.851 0.0641 .   
## earningsAcrossRounds 0.56765 0.56855 0.998 0.3181   
## linExpAcrossRounds -0.50907 0.50201 -1.014 0.3105   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 30261 on 32166 degrees of freedom  
## Residual deviance: 30217 on 32160 degrees of freedom  
## (248 observations deleted due to missingness)  
## AIC: 30229  
##   
## Number of Fisher Scoring iterations: 4

# Just include earnings and expectations across rounds (remove earnings and expectations within round)  
modelS4 =glm(choice ~ 0 + pastOC1sc + signedShiftsc + earningsAcrossRounds + linExpAcrossRounds, data=rdmDFclean, family="binomial", offset=predTrialLevModel)  
summary(modelS4);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc + signedShiftsc + earningsAcrossRounds +   
## linExpAcrossRounds, family = "binomial", data = rdmDFclean,   
## offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.1411 0.0493 -2.862 0.00421 \*\*   
## signedShiftsc 0.5001 0.2016 2.480 0.01314 \*   
## earningsAcrossRounds 1.5371 0.3651 4.210 2.55e-05 \*\*\*  
## linExpAcrossRounds -1.2606 0.3185 -3.958 7.57e-05 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 30261 on 32166 degrees of freedom  
## Residual deviance: 30229 on 32162 degrees of freedom  
## (248 observations deleted due to missingness)  
## AIC: 30237  
##   
## Number of Fisher Scoring iterations: 4

# Do people who switch conditions vs. repeat conditions treat earnings and expectations differently across rounds?  
  
# defining condition codes:  
condcode1 = rcsSubLevelWide\_clean$subID[rcsSubLevelWide\_clean$condCode==1]  
condcode2 = rcsSubLevelWide\_clean$subID[rcsSubLevelWide\_clean$condCode==2]  
condcode3 = rcsSubLevelWide\_clean$subID[rcsSubLevelWide\_clean$condCode==3]  
condcode4 = rcsSubLevelWide\_clean$subID[rcsSubLevelWide\_clean$condCode==4]  
  
  
# Subset data for those who repeated conditions (condition codes 1 and 4)  
repeatconditions = c(condcode1, condcode4)  
rdmDFrepeatCond = rdmDFclean[as.numeric(rdmDFclean$subID) %in% repeatconditions,]  
  
# Subset data for those who switched conditions (condition codes 2 and 3)  
switchconditions = c(condcode2, condcode3)  
rdmDFswitchCond = rdmDFclean[as.numeric(rdmDFclean$subID) %in% switchconditions,]  
  
  
# Run trial-level models that include round x strategy as we did in model 1 in main analysis:  
trialLevel\_repeatConditions= glmer(choice ~ 1 + gainScaled + safeScaled + evLevScaled + roundRecode\*strategyRecode + (1|subID), data=rdmDFrepeatCond , family = "binomial")  
summary(trialLevel\_repeatConditions);

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: choice ~ 1 + gainScaled + safeScaled + evLevScaled + roundRecode \*   
## strategyRecode + (1 | subID)  
## Data: rdmDFrepeatCond  
##   
## AIC BIC logLik deviance df.resid   
## 15488.1 15549.7 -7736.1 15472.1 16206   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -90.322 -0.591 0.174 0.580 15.134   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## subID (Intercept) 0.8174 0.9041   
## Number of obs: 16214, groups: subID, 62  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) 0.013877 0.122111 0.114 0.90952   
## gainScaled 13.198947 0.999972 13.199 < 2e-16 \*\*\*  
## safeScaled -17.069276 1.967635 -8.675 < 2e-16 \*\*\*  
## evLevScaled -8.120855 3.893653 -2.086 0.03701 \*   
## roundRecode -0.004084 0.019943 -0.205 0.83773   
## strategyRecode 0.265200 0.116617 2.274 0.02296 \*   
## roundRecode:strategyRecode 0.054795 0.019945 2.747 0.00601 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) gnScld sfScld evLvSc rndRcd strtgR  
## gainScaled -0.001   
## safeScaled 0.001 0.925   
## evLevScaled -0.012 -0.980 -0.981   
## roundRecode 0.001 -0.019 -0.014 0.017   
## strategyRcd 0.000 0.000 -0.007 0.003 0.001   
## rndRcd:strR 0.002 0.016 0.008 -0.013 0.013 0.000

trialLevel\_swithConditions= glmer(choice ~ 1 + gainScaled + safeScaled + evLevScaled + roundRecode\*strategyRecode + (1|subID), data=rdmDFswitchCond , family = "binomial")  
summary(trialLevel\_swithConditions);

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: choice ~ 1 + gainScaled + safeScaled + evLevScaled + roundRecode \*   
## strategyRecode + (1 | subID)  
## Data: rdmDFswitchCond  
##   
## AIC BIC logLik deviance df.resid   
## 15620.4 15681.9 -7802.2 15604.4 16192   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -117.812 -0.599 0.069 0.589 11.649   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## subID (Intercept) 1.408 1.186   
## Number of obs: 16200, groups: subID, 62  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -0.12379 0.15642 -0.791 0.4287   
## gainScaled 11.95343 1.13863 10.498 < 2e-16 \*\*\*  
## safeScaled -15.31422 2.22235 -6.891 5.54e-12 \*\*\*  
## evLevScaled -8.04819 4.44424 -1.811 0.0702 .   
## roundRecode -0.01106 0.01987 -0.557 0.5778   
## strategyRecode 0.09332 0.01989 4.692 2.70e-06 \*\*\*  
## roundRecode:strategyRecode 0.18180 0.15216 1.195 0.2322   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) gnScld sfScld evLvSc rndRcd strtgR  
## gainScaled 0.002   
## safeScaled 0.005 0.949   
## evLevScaled -0.011 -0.987 -0.986   
## roundRecode 0.000 -0.014 -0.014 0.014   
## strategyRcd -0.001 0.018 0.003 -0.011 -0.006   
## rndRcd:strR -0.002 -0.003 -0.006 0.004 0.001 0.000

# Trial-level model summaries for switch vs repeat conditions -> strategy increases risk-taking for everyone, but this effect is stronger over time for people who repeat condition. More time with specific strategy = stronger effect of that strategy.  
  
  
# Save predicted values to the switch and repeat datasets  
rdmDFrepeatCond$pred= predict(trialLevel\_repeatConditions,type="link");   
rdmDFswitchCond$pred= predict(trialLevel\_swithConditions,type="link");   
  
# Do we see the same temporal context effects as above in the whole dataset  
# For repeat conditions:  
model1\_repeatConditions = glm(choice ~ 0 + pastOC1sc + signedShiftsc + linExpectation + earnNormalizedOverall, data=rdmDFrepeatCond, family="binomial", offset=pred);  
summary(model1\_repeatConditions);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc + signedShiftsc + linExpectation +   
## earnNormalizedOverall, family = "binomial", data = rdmDFrepeatCond,   
## offset = pred)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.19371 0.06969 -2.780 0.005441 \*\*   
## signedShiftsc 0.43834 0.28725 1.526 0.127012   
## linExpectation -0.96906 0.29042 -3.337 0.000847 \*\*\*  
## earnNormalizedOverall 1.32371 0.35448 3.734 0.000188 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 15055 on 16090 degrees of freedom  
## Residual deviance: 15031 on 16086 degrees of freedom  
## (124 observations deleted due to missingness)  
## AIC: 15039  
##   
## Number of Fisher Scoring iterations: 4

# main effects as above except no effect of signed shift (p = .13) in people who repeat condition  
  
# switch:  
model1\_switchConditions = glm(choice ~ 0 + pastOC1sc + signedShiftsc + linExpectation + earnNormalizedOverall, data=rdmDFswitchCond, family="binomial", offset=pred);  
summary(model1\_switchConditions);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc + signedShiftsc + linExpectation +   
## earnNormalizedOverall, family = "binomial", data = rdmDFswitchCond,   
## offset = pred)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.15647 0.07061 -2.216 0.02670 \*   
## signedShiftsc 0.60204 0.28439 2.117 0.03427 \*   
## linExpectation -0.77153 0.29361 -2.628 0.00860 \*\*  
## earnNormalizedOverall 1.09369 0.36128 3.027 0.00247 \*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 15179 on 16076 degrees of freedom  
## Residual deviance: 15160 on 16072 degrees of freedom  
## (124 observations deleted due to missingness)  
## AIC: 15168  
##   
## Number of Fisher Scoring iterations: 3

# main effects same as above - including effect of signed shift for people who switch conditions  
  
  
  
# Could people who switch vs. repeat be treating expectations and earnings differently (i.e. tracking earnings across rounds)?  
  
# Repeat:  
model2\_repeatcond\_acrossRounds = glm(choice ~ 0 + pastOC1sc + signedShiftsc + linExpAcrossRounds + earningsAcrossRounds, data=rdmDFrepeatCond, family="binomial", offset=pred);  
summary(model2\_repeatcond\_acrossRounds);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc + signedShiftsc + linExpAcrossRounds +   
## earningsAcrossRounds, family = "binomial", data = rdmDFrepeatCond,   
## offset = pred)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.16584 0.06954 -2.385 0.0171 \*   
## signedShiftsc 0.43784 0.28677 1.527 0.1268   
## linExpAcrossRounds -1.76568 0.45233 -3.903 9.48e-05 \*\*\*  
## earningsAcrossRounds 2.12118 0.51788 4.096 4.21e-05 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 15055 on 16090 degrees of freedom  
## Residual deviance: 15030 on 16086 degrees of freedom  
## (124 observations deleted due to missingness)  
## AIC: 15038  
##   
## Number of Fisher Scoring iterations: 4

#AIC is an improvement from model above with expectations and earnings within round (AIC: 15039)   
  
# Switch  
model2\_switchcond\_acrossRounds = glm(choice ~ 0 + pastOC1sc + signedShiftsc + linExpAcrossRounds + earningsAcrossRounds, data=rdmDFswitchCond, family="binomial", offset=pred);  
summary(model2\_switchcond\_acrossRounds);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc + signedShiftsc + linExpAcrossRounds +   
## earningsAcrossRounds, family = "binomial", data = rdmDFswitchCond,   
## offset = pred)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.11390 0.07008 -1.625 0.1041   
## signedShiftsc 0.57461 0.28387 2.024 0.0429 \*  
## linExpAcrossRounds -0.78267 0.45090 -1.736 0.0826 .  
## earningsAcrossRounds 0.98242 0.51749 1.898 0.0576 .  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 15179 on 16076 degrees of freedom  
## Residual deviance: 15168 on 16072 degrees of freedom  
## (124 observations deleted due to missingness)  
## AIC: 15176  
##   
## Number of Fisher Scoring iterations: 3

# AIC much worse than model with linear expectations and earnings within round (AIC: 15160)  
  
# Summary -> people who repeat conditions seem to track expectations and earnings across rounds (direction of effects are consistent across groups though) but people who switch appear to treat expectations and earnings separately across rounds.

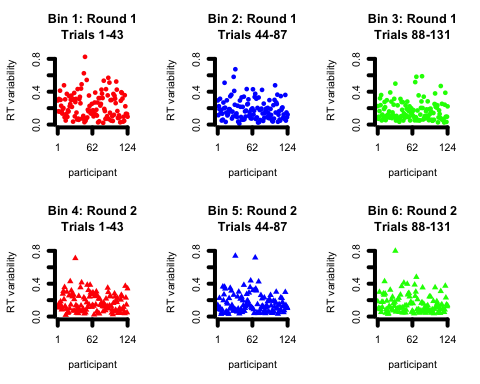
# Does strategy interact with temporal context?  
modelS5= glm(formula = choice ~ 0 + pastOC1sc\*strategyRecode + signedShiftsc\*strategyRecode + earnNormalizedOverall\*strategyRecode + linExpectation\*strategyRecode, family = "binomial", data = rdmDFclean, offset = predTrialLevModel)  
summary(modelS5);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc \* strategyRecode + signedShiftsc \*   
## strategyRecode + earnNormalizedOverall \* strategyRecode +   
## linExpectation \* strategyRecode, family = "binomial", data = rdmDFclean,   
## offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.17760 0.04959 -3.581 0.000342 \*\*\*  
## strategyRecode -0.08464 0.03221 -2.627 0.008604 \*\*   
## signedShiftsc 0.52432 0.20213 2.594 0.009489 \*\*   
## earnNormalizedOverall 1.19847 0.25290 4.739 2.15e-06 \*\*\*  
## linExpectation -0.85947 0.20636 -4.165 3.12e-05 \*\*\*  
## pastOC1sc:strategyRecode 0.09221 0.05568 1.656 0.097728 .   
## strategyRecode:signedShiftsc 0.34395 0.20250 1.699 0.089399 .   
## strategyRecode:earnNormalizedOverall -0.05615 0.25483 -0.220 0.825596   
## strategyRecode:linExpectation 0.16695 0.21596 0.773 0.439487   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 30261 on 32166 degrees of freedom  
## Residual deviance: 30207 on 32157 degrees of freedom  
## (248 observations deleted due to missingness)  
## AIC: 30225  
##   
## Number of Fisher Scoring iterations: 4

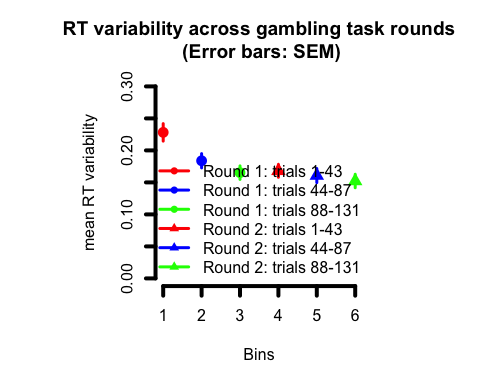
# Does the effect of strategy on context vary with round?   
modelS6 = glm(formula = choice ~ 0 + pastOC1sc\*strategyRecode\*roundRecode + signedShiftsc\*strategyRecode\*roundRecode + earnNormalizedOverall\*strategyRecode\*roundRecode + linExpectation\*strategyRecode\*roundRecode, family = "binomial", data = rdmDFclean, offset = predTrialLevModel)  
summary(modelS6)

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc \* strategyRecode \* roundRecode +   
## signedShiftsc \* strategyRecode \* roundRecode + earnNormalizedOverall \*   
## strategyRecode \* roundRecode + linExpectation \* strategyRecode \*   
## roundRecode, family = "binomial", data = rdmDFclean, offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value  
## pastOC1sc -0.177811 0.049623 -3.583  
## strategyRecode -0.083395 0.032228 -2.588  
## roundRecode 0.002057 0.032229 0.064  
## signedShiftsc 0.524585 0.202339 2.593  
## earnNormalizedOverall 1.197887 0.255285 4.692  
## linExpectation -0.859308 0.208308 -4.125  
## pastOC1sc:strategyRecode 0.090644 0.055723 1.627  
## pastOC1sc:roundRecode 0.065774 0.055725 1.180  
## strategyRecode:roundRecode -0.030176 0.032226 -0.936  
## strategyRecode:signedShiftsc 0.344605 0.202699 1.700  
## roundRecode:signedShiftsc -0.084039 0.202696 -0.415  
## strategyRecode:earnNormalizedOverall -0.027505 0.257189 -0.107  
## roundRecode:earnNormalizedOverall -0.162579 0.257235 -0.632  
## strategyRecode:linExpectation 0.142014 0.217804 0.652  
## roundRecode:linExpectation 0.096686 0.217850 0.444  
## pastOC1sc:strategyRecode:roundRecode 0.019266 0.055709 0.346  
## strategyRecode:roundRecode:signedShiftsc 0.357323 0.202699 1.763  
## strategyRecode:roundRecode:earnNormalizedOverall -0.018356 0.257246 -0.071  
## strategyRecode:roundRecode:linExpectation 0.066684 0.217862 0.306  
## Pr(>|z|)   
## pastOC1sc 0.000339 \*\*\*  
## strategyRecode 0.009663 \*\*   
## roundRecode 0.949116   
## signedShiftsc 0.009525 \*\*   
## earnNormalizedOverall 2.7e-06 \*\*\*  
## linExpectation 3.7e-05 \*\*\*  
## pastOC1sc:strategyRecode 0.103800   
## pastOC1sc:roundRecode 0.237869   
## strategyRecode:roundRecode 0.349076   
## strategyRecode:signedShiftsc 0.089116 .   
## roundRecode:signedShiftsc 0.678430   
## strategyRecode:earnNormalizedOverall 0.914834   
## roundRecode:earnNormalizedOverall 0.527369   
## strategyRecode:linExpectation 0.514383   
## roundRecode:linExpectation 0.657175   
## pastOC1sc:strategyRecode:roundRecode 0.729467   
## strategyRecode:roundRecode:signedShiftsc 0.077930 .   
## strategyRecode:roundRecode:earnNormalizedOverall 0.943114   
## strategyRecode:roundRecode:linExpectation 0.759541   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 30261 on 32166 degrees of freedom  
## Residual deviance: 30200 on 32147 degrees of freedom  
## (248 observations deleted due to missingness)  
## AIC: 30238  
##   
## Number of Fisher Scoring iterations: 4

# split up trials across rounds into 6 bins (3 in each round)  
# bin 1 has 43 trials and 2 & 3 has 44 trials  
  
RTvariability = as.data.frame(matrix(data=NA, nrow=nSub, ncol=6, dimnames = list(c(NULL), c("bin1", "bin2", "bin3", "bin4", "bin5", "bin6"))))  
  
for (s in 1:nSub) {  
 subdata = rdmDFclean[rdmDFclean$subID==subIDchar[s],]  
   
 RTvariability$bin1[s] = var(subdata$RT[subdata$roundRDM==1 & subdata$trial %in% c(1:43)])  
 RTvariability$bin2[s] = var(subdata$RT[subdata$roundRDM==1 & subdata$trial %in% c(44:87)])  
 RTvariability$bin3[s] = var(subdata$RT[subdata$roundRDM==1 & subdata$trial %in% c(88:131)])  
  
 RTvariability$bin4[s] = var(subdata$RT[subdata$roundRDM==2 & subdata$trial %in% c(1:43)])  
 RTvariability$bin5[s] = var(subdata$RT[subdata$roundRDM==2 & subdata$trial %in% c(44:87)])  
 RTvariability$bin6[s] = var(subdata$RT[subdata$roundRDM==2 & subdata$trial %in% c(88:131)])  
}  
  
  
par(mfrow = c(2,3), pty="s")  
plot(RTvariability$bin1, ylim=c(0, .85), ylab="RT variability", main="Bin 1: Round 1\nTrials 1-43", xlab="participant", pch=16, lwd=4, col="red", axes=F)  
axis(1, at = c(1,62,124), lwd=4)  
axis(2, lwd=4)  
plot(RTvariability$bin2, ylim=c(0, .85), ylab="RT variability", main="Bin 2: Round 1\nTrials 44-87", xlab="participant", pch=16, lwd=4, col="blue", axes=F)  
axis(1, at = c(1,62,124), lwd=4)  
axis(2, lwd=4)  
plot(RTvariability$bin3, ylim=c(0, .85), ylab="RT variability", main="Bin 3: Round 1\nTrials 88-131", xlab="participant", pch=16, lwd=4, col="green", axes=F)  
axis(1, at = c(1,62,124), lwd=4)  
axis(2, lwd=4)  
plot(RTvariability$bin4, ylim=c(0, .85), ylab="RT variability", main="Bin 4: Round 2\nTrials 1-43", xlab="participant", pch=17, lwd=4, col="red", axes=F)  
axis(1, at = c(1,62,124), lwd=4)  
axis(2, lwd=4)  
plot(RTvariability$bin5, ylim=c(0, .85), ylab="RT variability", main="Bin 5: Round 2\nTrials 44-87", xlab="participant", pch=17, lwd=4, col="blue", axes=F)  
axis(1, at = c(1,62,124), lwd=4)  
axis(2, lwd=4)  
plot(RTvariability$bin6, ylim=c(0, .85), ylab="RT variability", main="Bin 6: Round 2\nTrials 88-131", xlab="participant", pch=17, lwd=4, col="green", axes=F)  
axis(1, at = c(1,62,124), lwd=4)  
axis(2, lwd=4)



# calculate variability in RT within each bin for each participant. Then take the mean variability across people.  
  
meanRTbins = colMeans(RTvariability)  
semRTbins = c(sem(RTvariability$bin1),sem(RTvariability$bin2),sem(RTvariability$bin3),sem(RTvariability$bin4),sem(RTvariability$bin5),sem(RTvariability$bin6))  
upperError = meanRTbins + semRTbins  
lowerError = meanRTbins - semRTbins  
  
  
par(mfrow=c(1,1))  
plot(meanRTbins, ylim=c(0,.3), main="RT variability across gambling task rounds\n (Error bars: SEM)", xlab="Bins", ylab="mean RT variability", axes=F, pch=c(16,16, 16, 17,17,17), col = c("red", "blue", "green", "red", "blue", "green"), cex=1.5)  
arrows(c(1:6),lowerError, c(1:6), upperError, length=0, col = c("red", "blue", "green", "red", "blue", "green"), lwd=3)  
axis(1, at = c(1:6), labels = c(1:6), lwd=4)  
axis(2, lwd=4)  
legend("bottomleft", legend=c("Round 1: trials 1-43", "Round 1: trials 44-87", "Round 1: trials 88-131", "Round 2: trials 1-43", "Round 2: trials 44-87", "Round 2: trials 88-131"),lty=1, lwd=3, bty="n",col = c("red", "blue", "green", "red", "blue", "green"), cex=1, pch=c(16,16, 16, 17,17,17))



# compare variability in reaction time between strategy and act natural  
var(rdmDFclean$RT[rdmDFclean$strategy==0]); # act natural

## [1] 0.2519441

var(rdmDFclean$RT[rdmDFclean$strategy==1]); # strategy

## [1] 0.2677578

var.test(rdmDFclean$RT[rdmDFclean$strategyRecode==-1], rdmDFclean$RT[rdmDFclean$strategyRecode==1])

##   
## F test to compare two variances  
##   
## data: rdmDFclean$RT[rdmDFclean$strategyRecode == -1] and rdmDFclean$RT[rdmDFclean$strategyRecode == 1]  
## F = 0.94094, num df = 16207, denom df = 16205, p-value = 0.0001069  
## alternative hypothesis: true ratio of variances is not equal to 1  
## 95 percent confidence interval:  
## 0.9124074 0.9703658  
## sample estimates:  
## ratio of variances   
## 0.9409405

# variability in RT is significantly larger in strategy condition

# MOTIVATION  
# Does motivation interact with strategy to influence risk-taking?  
modelS7a\_motivationOnly = glm(choice~0+pastOC1sc\*strategyRecode + signedShiftsc\*strategyRecode + earnNormalizedOverall\*strategyRecode + linExpectation\*strategyRecode + strategyRecode\*motivationNumeric, data=rdmDFclean, family="binomial", offset=predTrialLevModel);  
summary(modelS7a\_motivationOnly);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc \* strategyRecode + signedShiftsc \*   
## strategyRecode + earnNormalizedOverall \* strategyRecode +   
## linExpectation \* strategyRecode + strategyRecode \* motivationNumeric,   
## family = "binomial", data = rdmDFclean, offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.15889 0.05459 -2.910 0.00361 \*\*   
## strategyRecode -0.09760 0.07378 -1.323 0.18587   
## signedShiftsc 0.53307 0.20241 2.634 0.00845 \*\*   
## earnNormalizedOverall 1.17114 0.25502 4.592 4.38e-06 \*\*\*  
## linExpectation -0.80903 0.21516 -3.760 0.00017 \*\*\*  
## motivationNumeric -0.03252 0.03948 -0.824 0.41002   
## pastOC1sc:strategyRecode 0.09192 0.05569 1.651 0.09879 .   
## strategyRecode:signedShiftsc 0.34430 0.20248 1.700 0.08905 .   
## strategyRecode:earnNormalizedOverall -0.05678 0.25497 -0.223 0.82377   
## strategyRecode:linExpectation 0.16781 0.21607 0.777 0.43737   
## strategyRecode:motivationNumeric 0.01760 0.09011 0.195 0.84513   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 30261 on 32166 degrees of freedom  
## Residual deviance: 30206 on 32155 degrees of freedom  
## (248 observations deleted due to missingness)  
## AIC: 30228  
##   
## Number of Fisher Scoring iterations: 4

# ERQ REAPPRAISAL  
modelS7b\_reappraisalOnly = glm(choice~0+pastOC1sc\*strategyRecode + signedShiftsc\*strategyRecode + earnNormalizedOverall\*strategyRecode + linExpectation\*strategyRecode + strategyRecode\*reapSpan0mean, data=rdmDFclean, family="binomial", offset=predTrialLevModel);  
summary(modelS7b\_reappraisalOnly);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc \* strategyRecode + signedShiftsc \*   
## strategyRecode + earnNormalizedOverall \* strategyRecode +   
## linExpectation \* strategyRecode + strategyRecode \* reapSpan0mean,   
## family = "binomial", data = rdmDFclean, offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -1.777e-01 5.023e-02 -3.538 0.000403 \*\*\*  
## strategyRecode -7.066e-02 3.282e-02 -2.153 0.031322 \*   
## signedShiftsc 4.947e-01 2.036e-01 2.430 0.015117 \*   
## earnNormalizedOverall 1.262e+00 2.576e-01 4.898 9.66e-07 \*\*\*  
## linExpectation -9.071e-01 2.101e-01 -4.317 1.58e-05 \*\*\*  
## reapSpan0mean -1.471e-02 3.756e-02 -0.392 0.695248   
## pastOC1sc:strategyRecode 8.804e-02 5.624e-02 1.565 0.117484   
## strategyRecode:signedShiftsc 3.095e-01 2.040e-01 1.517 0.129223   
## strategyRecode:earnNormalizedOverall 9.194e-05 2.595e-01 0.000 0.999717   
## strategyRecode:linExpectation 1.200e-01 2.195e-01 0.547 0.584518   
## strategyRecode:reapSpan0mean -8.878e-02 3.792e-02 -2.341 0.019212 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 29800 on 31647 degrees of freedom  
## Residual deviance: 29741 on 31636 degrees of freedom  
## (767 observations deleted due to missingness)  
## AIC: 29763  
##   
## Number of Fisher Scoring iterations: 4

# ERQ SUPPRESSION  
# Does habitual use of expressive suppression interact with strategy to influence risk-taking?  
modelS7c\_suppressionOnly = glm(choice~0+pastOC1sc\*strategyRecode + signedShiftsc\*strategyRecode + earnNormalizedOverall\*strategyRecode + linExpectation\*strategyRecode + strategyRecode\*suppSpan0mean, data=rdmDFclean, family="binomial", offset=predTrialLevModel);  
summary(modelS7c\_suppressionOnly);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc \* strategyRecode + signedShiftsc \*   
## strategyRecode + earnNormalizedOverall \* strategyRecode +   
## linExpectation \* strategyRecode + strategyRecode \* suppSpan0mean,   
## family = "binomial", data = rdmDFclean, offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.17674 0.05052 -3.498 0.000469 \*\*\*  
## strategyRecode -0.07369 0.03354 -2.197 0.028008 \*   
## signedShiftsc 0.49647 0.20369 2.437 0.014794 \*   
## earnNormalizedOverall 1.27541 0.25747 4.954 7.28e-07 \*\*\*  
## linExpectation -0.91589 0.20981 -4.365 1.27e-05 \*\*\*  
## suppSpan0mean -0.01094 0.01999 -0.547 0.584317   
## pastOC1sc:strategyRecode 0.08847 0.05624 1.573 0.115711   
## strategyRecode:signedShiftsc 0.31416 0.20402 1.540 0.123604   
## strategyRecode:earnNormalizedOverall 0.02908 0.25969 0.112 0.910844   
## strategyRecode:linExpectation 0.09685 0.21964 0.441 0.659252   
## strategyRecode:suppSpan0mean -0.02185 0.02058 -1.061 0.288552   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 29800 on 31647 degrees of freedom  
## Residual deviance: 29745 on 31636 degrees of freedom  
## (767 observations deleted due to missingness)  
## AIC: 29767  
##   
## Number of Fisher Scoring iterations: 4

# COMPOSITE SPAN (WORKING MEMORY CAPACITY)  
# Does working memory capacity interact with strategy to influence risk-taking?  
modelS7d\_compositeSpanOnly = glm(choice~0+pastOC1sc\*strategyRecode + signedShiftsc\*strategyRecode + earnNormalizedOverall\*strategyRecode + linExpectation\*strategyRecode + strategyRecode\*compositeSpanScore, data=rdmDFclean, family="binomial", offset=predTrialLevModel);  
summary(modelS7d\_compositeSpanOnly);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc \* strategyRecode + signedShiftsc \*   
## strategyRecode + earnNormalizedOverall \* strategyRecode +   
## linExpectation \* strategyRecode + strategyRecode \* compositeSpanScore,   
## family = "binomial", data = rdmDFclean, offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.206062 0.058909 -3.498 0.000469 \*\*\*  
## strategyRecode -0.039459 0.053763 -0.734 0.462988   
## signedShiftsc 0.154198 0.222409 0.693 0.488115   
## earnNormalizedOverall 1.210543 0.282489 4.285 1.83e-05 \*\*\*  
## linExpectation -0.855756 0.237161 -3.608 0.000308 \*\*\*  
## compositeSpanScore -0.008379 0.046920 -0.179 0.858275   
## pastOC1sc:strategyRecode 0.101127 0.061657 1.640 0.100977   
## strategyRecode:signedShiftsc 0.369715 0.222628 1.661 0.096777 .   
## strategyRecode:earnNormalizedOverall -0.103955 0.282100 -0.369 0.712497   
## strategyRecode:linExpectation 0.173619 0.239236 0.726 0.468010   
## strategyRecode:compositeSpanScore -0.032308 0.070604 -0.458 0.647240   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 24293 on 26197 degrees of freedom  
## Residual deviance: 24250 on 26186 degrees of freedom  
## (6217 observations deleted due to missingness)  
## AIC: 24272  
##   
## Number of Fisher Scoring iterations: 4

# Interact past outcome with both global timescale variables:  
modelS8\_POCxEarn\_POCxExp = glm(choice ~ 0 + pastOC1sc + signedShiftsc + earnNormalizedOverall\*pastOC1sc + linExpectation\*pastOC1sc, data=rdmDFclean, family="binomial", offset=predTrialLevModel)  
summary(modelS8\_POCxEarn\_POCxExp);

##   
## Call:  
## glm(formula = choice ~ 0 + pastOC1sc + signedShiftsc + earnNormalizedOverall \*   
## pastOC1sc + linExpectation \* pastOC1sc, family = "binomial",   
## data = rdmDFclean, offset = predTrialLevModel)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## pastOC1sc -0.34588 0.07866 -4.397 1.1e-05 \*\*\*  
## signedShiftsc 0.53988 0.20222 2.670 0.00759 \*\*   
## earnNormalizedOverall 0.27013 0.35897 0.753 0.45174   
## linExpectation -0.14877 0.29185 -0.510 0.61023   
## pastOC1sc:earnNormalizedOverall 3.42749 0.96449 3.554 0.00038 \*\*\*  
## pastOC1sc:linExpectation -2.39657 0.79483 -3.015 0.00257 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 30261 on 32166 degrees of freedom  
## Residual deviance: 30199 on 32160 degrees of freedom  
## (248 observations deleted due to missingness)  
## AIC: 30211  
##   
## Number of Fisher Scoring iterations: 4