**Supplementary Materials**

**Table S1**

*Correlation Matrix of Outcome Variables*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Phonological Processing** | | | **Rapid Automatized Naming** | | | **Verbal Working Memory** | | |
|  | Elision | Blending | NWR | Numbers | Letters | 2Set | Forwards | Backwards | Sequencing |
| Blending | 0.28 |  |  |  |  |  |  |  |  |
|  | *p*=.005 |  |  |  |  |  |  |  |  |
| NWR | 0.25 | 0.37\* |  |  |  |  |  |  |  |
| *p*=.013 | *p<*.001 |  |  |  |  |  |  |  |
| Numbers | -0.04 | -0.02 | -0.27 |  |  |  |  |  |  |
|  | *p*=.723 | *p*=.880 | *p*=.008 |  |  |  |  |  |  |
| Letters | -0.01 | -0.10 | -0.20 | 0.84\* |  |  |  |  |  |
|  | *p*=.941 | *p*=.341 | *p*=.050 | *p<*.001 |  |  |  |  |  |
| 2 Set | -0.03 | -0.13 | -0.22 | 0.76\* | 0.78\* |  |  |  |  |
|  | *p*=.778 | *p*=.201 | *p*=.026 | *p<*.001 | *p<*.001 |  |  |  |  |
| Forwards | 0.14 | 0.10 | 0.36\* | -0.27 | -0.20 | 0.31\* |  |  |  |
|  | *p*=.175 | *p*=.346 | *p<*.001 | *p*=.005 | *p*=.037 | *p*=.001 |  |  |  |
| Backwards | 0.16 | 0.09 | 0.24 | -0.12 | -0.14 | -0.13 | 0.31\* |  |  |
|  | *p*=.120 | *p*=.402 | *p*=.015 | *p*=.222 | *p*=.157 | *p*=.182 | *p*=.001 |  |  |
| Sequencing | 0.14 | 0.21 | 0.08 | -0.23 | -0.25 | -0.20 | 0.14 | 0.26 |  |
|  | *p*=.179 | *p*=.041 | *p*=.456 | *p*=.015 | *p*=.011 | *p*=.041 | *p*=.142 | *p*=.008 |  |
| Reading Fluency | 0.16 | 0.01 | -0.08 | -0.15 | -0.20 | -0.24 | 0.14 | 0.09 | 0.07 |
| *p*=.116 | *p*=.910 | *p*=.454 | *p*=.126 | *p*=.049 | *p*=.016 | *p*=.159 | *p*=.356 | *p*=.456 |

**Table S1** presents correlations between outcome variables expressed in Pearson’s R-values, and the corresponding p-values. Phonological Processing was assessed using the Elision, Blending, and Nonword Repetition (NWR) subtests of the CTOPP and CTOPP-II at <MASKED> and <MASKED>, respectively (Wagner et al., 1999, 2003). Rapid Automatized Naming was assessed using the Numbers, Letters, and 2-Set subtests of the RAN/RAS (Wolf & Denckla, 2005). Verbal Working Memory was assessed using the Forwards, Backwards, and Sequencing subtests of the WAIS-IV (Wechsler, 2014). Reading fluency was assessed using the Sentence Reading Fluency subtest of the WJ-III (Woodcock, et al., 2001). \*indicates statistical significance at .05 level following Holms-Bonferroni correction for multiple comparisons.

**Power Analysis**

The power analysis was conducted in the R package WebPower (https://webpower.psychstat.org) and replicated in G\*Power (Faul, Erdfelder, Lang, & Buchner, 2007). Our study included 108 subjects across three groups and two sites. We used a two-tailed test (alpha =.05) to compare group means across 9 variables of interest with collection site included as a covariate. The resulting power was 0.0848.

**Code used for statistical analyses**

The R package psych (version 1.9.12, http://personality-project.org/r/psych) was used for descriptive data analyses. The R packages car (3.0, https://cran.r-project.org/web/packages/car/), MASS (7.3-51.3, https://cran.r-project.org/web/packages/MASS/), mvoutlier (2.0.9, https://cran.r-project.org/web/packages/mvoutlier/), mvnormtest (0.1-9, https://cran.r-project.org/web/packages/mvnormtest/), pastecs (1.3.21, https://cran.r-project.org/web/packages/pastecs/), reshape2 (1.4.3, https://cran.r-project.org/web/packages/reshape2/), WRS2 (1.0-0, https://cran.r-project.org/web/packages/WRS2/), and heplots (1.3-5, http://datavis.ca/R/index.php#heplots) were used to support and conduct the MANOVA analyses. The R packages ggplot 2 (3.2.1, https://ggplot2.tidyverse.org), tidyr (0.8.3, https://tidyr.tidyverse.org), and plyr (1.8.4, http://had.co.nz/plyr/) were used to restructure data and create figures.

**#R package descriptive statistics**

library(psych)

**#POMS Ceiling**

RAN Number (sample max) = 35 seconds

RAN Letter (sample max) = 31 seconds

RAN 2-set (sample max) = 33 seconds

Reading Fluency (max possible) = 98 correct responses

CTOPP Elision (max possible) = 20 correct

CTOPP-II Elision (max possible) = 34 correct

CTOPP Blending (max possible) = 20 correct

CTOPP-II Blending (max possible) = 33 correct

CTOPP Nonword Repetition (max possible) = 18 correct

CTOPP-II Nonword Repetition (max possible) = 30 correct

Digit Span Forward (max possible) = 16 correct

Digit Span Backward (max possible) = 16 correct

Digit Span Sequencing (max possible) = 16 correct

**#R Code for Descriptive Statistics (includes Standard Error of the Mean)**

describeBy(data$Elision\_Scaled, data$GroupCAT2)

describeBy(data$Blending\_Scaled, data$GroupCAT2)

describeBy(data$NWR\_Scaled, data$GroupCAT2)

describeBy(data$RANnum\_Scaled, data$GroupCAT2)

describeBy(data$RANlet\_Scaled, data$GroupCAT2)

describeBy(data$RAN2set\_Scaled, data$GroupCAT2)

describeBy(data$DSF\_Scaled, data$GroupCAT2)

describeBy(data$DSB\_Scaled, data$GroupCAT2)

describeBy(data$DSS\_Scaled, data$GroupCAT2)

describeBy(data$WJRF\_Scaled, data$GroupCAT2)

**#R Tests of Assumptions**

**#R code for Variance**

by(data$Elision\_Scaled, data$GroupCAT2, stat.desc, basic=FALSE)

by(data$Blending\_Scaled, data$GroupCAT2, stat.desc, basic=FALSE)

by(data$NWR\_Scaled, data$GroupCAT2, stat.desc, basic=FALSE)

by(data$RANnum\_Scaled, data$GroupCAT2, stat.desc, basic=FALSE)

by(data$RANlet\_Scaled, data$GroupCAT2, stat.desc, basic=FALSE)

by(data$RAN2set\_Scaled, data$GroupCAT2, stat.desc, basic=FALSE)

by(data$DSF\_Scaled, data$GroupCAT2, stat.desc, basic=FALSE)

by(data$DSB\_Scaled, data$GroupCAT2, stat.desc, basic=FALSE)

by(data$DSS\_Scaled, data$GroupCAT2, stat.desc, basic=FALSE)

by(data$WJRF\_Scaled, data$GroupCAT2, stat.desc, basic=FALSE)

**#R code for Covariance**

newdata<-data[c(-18, -24)]

by(data[,16:23], data$GroupCAT2, cov)

**#R code for Shapiro-Wilks Tests**

##### DLD #####

newDLDdata <- preshapirodata[ which(data$GroupCAT2=='DLD'), ]

newDLDdata2<-newDLDdata[c(-1:-15,-18, -24:-27)]

#Remove missing variables (casewise by person)

completeFun <- function(data, desiredCols) {

   completeVec <- complete.cases(data[, desiredCols])

   return(data[completeVec, ])

 }

newDLDdata3<-completeFun(newDLDdata2)

#Transform for Shaprio-Wilks Test

newDLDdata4<-t(newDLDdata3)

mshapiro.test(newDLDdata4)

##### S-RCD #####

newSRCDdata <- preshapirodata[ which(data$GroupCAT2=='S-RCD'), ]

newSRCDdata2<-newSRCDdata[c(-1:-15,-18, -24:-27)]

newSRCDdata3<-completeFun(newSRCDdata2)

newSRCDdata4<-t(newSRCDdata3)

mshapiro.test(newSRCDdata4)

##### S-RCD & DLD #####

newSRCDDLDdata <- preshapirodata[ which(data$GroupCAT2=='SRCD\_DLD'), ]

newSRCDDLDdata2<-newSRCDDLDdata[c(-1:-15,-18, -24:-27)]

newSRCDDLDdata3<-completeFun(newSRCDDLDdata2)

newSRCDDLDdata4<-t(newSRCDDLDdata3)

mshapiro.test(newSRCDDLDdata4)

##### TD #####

newTDdata <- preshapirodata[ which(data$GroupCAT2=='TD'), ]

newTDdata2<-newTDdata[c(-1:-15,-18, -24:-27)]

newTDdata3<-completeFun(newTDdata2)

newTDdata4<-t(newTDdata3)

mshapiro.test(newTDdata4)

**#R code for outlier plots**

aq.plot(newDLDdata3)

aq.plot(newSRCDdata3)

aq.plot(newSRCDDLDdata3)

aq.plot(newTDdata3)

**#R Packages for MANOVA**

library(car), library(ggplot2), library(MASS), library(mvoutlier), library(mvnormtest), library(pastecs), library(reshape2), library(WRS2), library(heplots)

**#Across all analyses**

Signif. codes:  0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

**#MANOVA data restructure**

out<-cbind(data$Elision\_Scaled, data$Blending\_Scaled, data$RANnum\_Scaled, data$RANlet\_Scaled, data$RAN2set\_Scaled, data$DSF\_Scaled, data$DSB\_Scaled, data$WJRF\_Scaled)

**#MANOVA Analysis**

model<-manova(out ~ GroupCAT2 + SiteCAT, data=data)

summary(model, intercept = TRUE, test="Pillai")

**#MANOVA Results**

summary(model, intercept = TRUE, test="Pillai")

Df Pillai approx F num Df den Df Pr(>F)

(Intercept) 1 0.99600 2519.23 8 81 < 2.2e-16 \*\*\*

GroupCAT2 3 0.52866 2.22 24 249 0.001278 \*\*

SiteCAT 1 0.12717 1.48 8 81 0.179219

Residuals 88

**#MANOVA data restructure**

Out2<-cbind(data$Blending\_Scaled, data$RANnum\_Scaled, data$RANlet\_Scaled, data$RAN2set\_Scaled, data$DSF\_Scaled, data$DSB\_Scaled, data$WJRF\_Scaled)

**#MANOVA Analysis**

model<-manova(out2 ~ GroupCAT2 + SiteCAT, data=data)

summary(model, intercept = TRUE, test="Pillai")

**#MANOVA Results**

summary(model, intercept = TRUE, test="Pillai")

Df Pillai approx F num Df den Df Pr(>F)

(Intercept) 1 0.99547 2575.36 7 82 < 2.2e-16 \*\*\*

GroupCAT2 3 0.43994 2.06 21 252 0.004947 \*\*

SiteCAT 1 0.12520 1.68 7 82 0.126237

Residuals 88

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

**# Follow-up ANOVA Analysis**

summary.aov(model)

**# Follow-up ANOVA Results**

Response 1: **Elision\_Scaled**

                    Df  Sum Sq  Mean Sq F value  Pr(>F)

**GroupCAT2    3 0.12254 0.040846  4.1306 0.00865 \*\***

SiteCAT          1 0.00184 0.001844  0.1865 0.66691

Residuals       88 0.87019 0.009889

 Response 2: Blending\_Scaled

            Df  Sum Sq   Mean Sq F value Pr(>F)

GroupCAT2    3 0.01723 0.0057449  0.5377 0.6577

SiteCAT      1 0.01104 0.0110387  1.0332 0.3122

Residuals   88 0.94023 0.0106844

 Response 3: RANnum\_Scaled

            Df  Sum Sq  Mean Sq F value Pr(>F)

GroupCAT2    3 0.08122 0.027073  1.9972 0.1202

SiteCAT      1 0.02526 0.025262  1.8636 0.1757

Residuals   88 1.19289 0.013556

 Response 4: **RANlet\_Scaled**

            Df  Sum Sq  Mean Sq F value  Pr(>F)

**GroupCAT2    3 0.12617 0.042056  3.2209 0.02651 \***

***SiteCAT      1 0.04395 0.043949  3.3658 0.06994 .***

Residuals   88 1.14904 0.013057

 Response 5: **RAN2set\_Scaled**

            Df  Sum Sq  Mean Sq F value  Pr(>F)

***GroupCAT2    3 0.09563 0.031876  2.3270 0.08011 .***

***SiteCAT      1 0.04687 0.046874  3.4219 0.06770 .***

Residuals   88 1.20547 0.013698

 Response 6: **DSF\_Scaled**

            Df  Sum Sq  Mean Sq F value  Pr(>F)

**GroupCAT2    3 0.20022 0.066741  3.1532 0.02883 \***

SiteCAT      1 0.01641 0.016408  0.7752 0.38101

Residuals   88 1.86262 0.021166

Response 7: **DSB\_Scaled**

            Df  Sum Sq  Mean Sq F value    Pr(>F)

**GroupCAT2    3 0.33749 0.112496  7.1614 0.0002337 \*\*\***

SiteCAT      1 0.00047 0.000465  0.0296 0.8637403

Residuals   88 1.38237 0.015709

Response 8: **WJRF\_Scaled**

            Df  Sum Sq  Mean Sq F value   Pr(>F)

**GroupCAT2    3 0.16576 0.055252  4.3661 0.006486 \*\***

SiteCAT      1 0.03235 0.032355  2.5567 0.113409

Residuals   88 1.11361 0.012655

**#Group Coding Output**

summary(GroupCAT2)

#1 = DLD

#2 = S-RCD

#3 = S-RCD & DLD

#4 = TD

**#Setting Contrasts for Linear Regression Analyses**

***#First Contrasts***

contrasts(data$GroupCAT2)<-contr.treatment(4, base=4)

DLD\_vs\_TD<-c(1,0,0,0)

SRCD\_vs\_TD<-c(0,1,0,0)

SRCDDLD\_vs\_TD<-c(0,0,1,0)

contrasts(data$GroupCAT2)<-cbind(DLD\_vs\_TD, SRCD\_vs\_TD, SRCDDLD\_vs\_TD)

***#Second Contrasts***

contrasts(data$GroupCAT2)<-contr.treatment(4, base=2)

DLD\_vs\_SRCDDLD<-c(1,0,0,0)

SRCD\_vs\_SRCDDLD<-c(0,1,0,0)

TD\_vs\_SRCDDLD<-c(0,0,0,1) #note. we already have this contrast from the previous analysis

contrasts(data$GroupCAT2)<-cbind(DLD\_vs\_SRCDDLD, SRCD\_vs\_SRCDDLD, TD\_vs\_SRCDDLD)

***#Third Contrasts***

contrasts(data$GroupCAT2)<-contr.treatment(4, base=2)

DLD\_vs\_SRCD<-c(1,0,0,0)

SRCDDLD\_vs\_SRCD<-c(0,0,1,0) #note. we already have this contrast from the previous analysis

TD\_vs\_SRCD<-c(0,0,0,1) #note. we already have this contrast from the previous analysis

contrasts(data$GroupCAT2)<-cbind(DLD\_vs\_SRCD, SRCDDLD\_vs\_SRCD, TD\_vs\_SRCD)

**#Linear Regression Analyses**

#Significant: Elision, Digit Span Forwards, Digit Span Backwards, Sentence Fluency, & RAN Letters

#Marginally Significant: RAN 2-set

**#Elision - Linear Regression Code**

ElisionModel<-lm(Elision\_Scaled ~ GroupCAT2, data=data) ***#First Contrasts***

ElisionModel<-lm(Elision\_Scaled ~ GroupCAT2, data=data) ***#Second Contrasts***

ElisionModel<-lm(Elision\_Scaled ~ GroupCAT2, data=data) ***#Third Contrasts***

**#Elision Models - Linear Regression**

summary(ElisionModel)  ***#First Contrasts***

lm(formula = Elision\_Scaled ~ GroupCAT2, data = data)

Residuals:

     Min       1Q Median       3Q Max

-0.50686 -0.03200  0.01474 0.05314 0.15818

Coefficients:

                       Estimate Std. Error t value Pr(>|t|)

(Intercept)             0.91200 0.02442 37.341  < 2e-16 \*\*\*

***GroupCAT2DLD\_vs\_TD     -0.05514 0.02882 -1.913  0.05866 .***

GroupCAT2SRCD\_vs\_TD    -0.01674 0.03499 -0.478  0.63351

**GroupCAT2SRCDDLD\_vs\_TD -0.12018    0.04100 -2.931 0.00421 \*\***

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1092 on 97 degrees of freedom

  (7 observations deleted due to missingness)

Multiple R-squared:  0.09608,    Adjusted R-squared:  0.06812

F-statistic: 3.437 on 3 and 97 DF,  p-value: 0.0199

summary(ElisionModel)  ***#Second Contrasts***

lm(formula = Elision\_Scaled ~ GroupCAT2, data = data)

Residuals:

     Min       1Q Median       3Q Max

-0.50686 -0.03200  0.01474 0.05314 0.15818

Coefficients:

                         Estimate Std. Error t value Pr(>|t|)

(Intercept)               0.79182 0.03293 24.043  < 2e-16 \*\*\*

***GroupCAT2DLD\_vs\_SRCDDLD   0.06504 0.03631 1.791  0.07636 .***

**GroupCAT2SRCD\_vs\_SRCDDLD  0.10344 0.04138 2.500  0.01411 \***

GroupCAT2TD\_vs\_SRCDDLD    0.12018 0.04100 2.931  0.00421 \*\*

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1092 on 97 degrees of freedom

  (7 observations deleted due to missingness)

Multiple R-squared:  0.09608,    Adjusted R-squared:  0.06812

F-statistic: 3.437 on 3 and 97 DF,  p-value: 0.0199

summary(ElisionModel)  ***#Third Contrasts***

lm(formula = Elision\_Scaled ~ GroupCAT2, data = data)

Residuals:

     Min       1Q Median       3Q Max

-0.50686 -0.03200  0.01474 0.05314 0.15818

Coefficients:

                         Estimate Std. Error t value Pr(>|t|)

(Intercept)               0.89526 0.02506 35.727   <2e-16 \*\*\*

GroupCAT2DLD\_vs\_SRCD     -0.03840 0.02936 -1.308   0.1940

GroupCAT2SRCDDLD\_vs\_SRCD -0.10344    0.04138 -2.500 0.0141 \*

GroupCAT2TD\_vs\_SRCD       0.01674 0.03499 0.478   0.6335

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1092 on 97 degrees of freedom

  (7 observations deleted due to missingness)

Multiple R-squared:  0.09608,    Adjusted R-squared:  0.06812

F-statistic: 3.437 on 3 and 97 DF,  p-value: 0.0199

**#Digit Span: Forward  - Linear Regression Code**

DSFModel<-lm(DSF\_Scaled ~ GroupCAT2, data=data) ***#First Contrasts***

DSFModel<-lm(DSF\_Scaled ~ GroupCAT2, data=data) ***#Second Contrasts***

DSFModel<-lm(DSF\_Scaled ~ GroupCAT2, data=data) ***#Third Contrasts***

**#Digit Span: Forward - Linear Regression**

summary(DSFModel)  ***#First Contrasts***

lm(formula = DSF\_Scaled ~ GroupCAT2, data = data)

Residuals:

     Min       1Q Median       3Q Max

-0.34200 -0.08216 -0.00475  0.09250 0.33250

Coefficients:

                         Estimate Std. Error t value Pr(>|t|)

(Intercept)             6.675e-01 3.159e-02 21.130   <2e-16 \*\*\*

**GroupCAT2DLD\_vs\_TD     -8.550e-02 3.689e-02 -2.318   0.0224 \***

GroupCAT2SRCD\_vs\_TD     1.573e-17 4.468e-02 0.000   1.0000

GroupCAT2SRCDDLD\_vs\_TD -4.135e-02  5.033e-02 -0.821 0.4133

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1413 on 104 degrees of freedom

Multiple R-squared:  0.07572,    Adjusted R-squared:  0.04906

F-statistic:  2.84 on 3 and 104 DF,  p-value: 0.04153

summary(DSFModel)  ***#Second Contrasts***

lm(formula = DSF\_Scaled ~ GroupCAT2, data = data)

Residuals:

     Min       1Q Median       3Q Max

-0.34200 -0.08216 -0.00475  0.09250 0.33250

Coefficients:

                         Estimate Std. Error t value Pr(>|t|)

(Intercept)               0.62615 0.03918 15.980   <2e-16 \*\*\*

GroupCAT2DLD\_vs\_SRCDDLD  -0.04415 0.04357 -1.013    0.313

GroupCAT2SRCD\_vs\_SRCDDLD  0.04135 0.05033 0.821    0.413

GroupCAT2TD\_vs\_SRCDDLD    0.04135 0.05033 0.821    0.413

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1413 on 104 degrees of freedom

Multiple R-squared:  0.07572,    Adjusted R-squared:  0.04906

F-statistic:  2.84 on 3 and 104 DF,  p-value: 0.04153

summary(DSFModel)  ***#Third Contrasts***

lm(formula = DSF\_Scaled ~ GroupCAT2, data = data)

Residuals:

     Min       1Q Median       3Q Max

-0.34200 -0.08216 -0.00475  0.09250 0.33250

Coefficients:

                           Estimate Std. Error t value Pr(>|t|)

(Intercept)               6.675e-01 3.159e-02 21.130   <2e-16 \*\*\*

**GroupCAT2DLD\_vs\_SRCD     -8.550e-02 3.689e-02 -2.318   0.0224 \***

GroupCAT2SRCDDLD\_vs\_SRCD -4.135e-02  5.033e-02 -0.821 0.4133

GroupCAT2TD\_vs\_SRCD      -1.229e-16 4.468e-02 0.000   1.0000

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1413 on 104 degrees of freedom

Multiple R-squared:  0.07572,    Adjusted R-squared:  0.04906

F-statistic:  2.84 on 3 and 104 DF,  p-value: 0.04153

**#Digit Span: Backward  - Linear Regression Code**

DSBModel<-lm(DSB\_Scaled ~ GroupCAT2, data=data) ***#First Contrasts***

DSBModel<-lm(DSB\_Scaled ~ GroupCAT2, data=data) ***#Second Contrasts***

DSBModel<-lm(DSB\_Scaled ~ GroupCAT2, data=data) ***#Third Contrasts***

**#Digit Span: Backward - Linear Regression**

summary(DSBModel)  ***#First Contrasts***

lm(formula = DSB\_Scaled ~ GroupCAT2, data = data)

Residuals:

     Min       1Q Median       3Q Max

-0.24370 -0.09208 -0.01615  0.05368 0.33600

Coefficients:

                        Estimate Std. Error t value Pr(>|t|)

(Intercept)             0.664000 0.027263 24.355  < 2e-16 \*\*\*

**GroupCAT2DLD\_vs\_TD     -0.130296 0.031915 -4.083 8.87e-05 \*\*\***

GroupCAT2SRCD\_vs\_TD    -0.007684 0.039060 -0.197   0.8444

**GroupCAT2SRCDDLD\_vs\_TD -0.077846   0.043437 -1.792 0.0761 .**

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1219 on 102 degrees of freedom

  (2 observations deleted due to missingness)

Multiple R-squared:  0.1933,    Adjusted R-squared:  0.1695

F-statistic: 8.145 on 3 and 102 DF,  p-value: 6.489e-05

summary(DSBModel)  ***#Second Contrasts***

lm(formula = DSB\_Scaled ~ GroupCAT2, data = data)

Residuals:

     Min       1Q Median       3Q Max

-0.24370 -0.09208 -0.01615  0.05368 0.33600

Coefficients:

                         Estimate Std. Error t value Pr(>|t|)

(Intercept)               0.58615 0.03382 17.334   <2e-16 \*\*\*

GroupCAT2DLD\_vs\_SRCDDLD  -0.05245 0.03767 -1.392   0.1668

GroupCAT2SRCD\_vs\_SRCDDLD  0.07016 0.04389 1.599   0.1130

GroupCAT2TD\_vs\_SRCDDLD    0.07785 0.04344 1.792   0.0761 .

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1219 on 102 degrees of freedom

  (2 observations deleted due to missingness)

Multiple R-squared:  0.1933,    Adjusted R-squared:  0.1695

F-statistic: 8.145 on 3 and 102 DF,  p-value: 6.489e-05

summary(DSBModel)  ***#Third Contrasts***

lm(formula = DSB\_Scaled ~ GroupCAT2, data = data)

Residuals:

     Min       1Q Median       3Q Max

-0.24370 -0.09208 -0.01615  0.05368 0.33600

Coefficients:

                          Estimate Std. Error t value Pr(>|t|)

(Intercept)               0.656316 0.027971 23.464  < 2e-16 \*\*\*

**GroupCAT2DLD\_vs\_SRCD     -0.122612 0.032522 -3.770 0.000274 \*\*\***

GroupCAT2SRCDDLD\_vs\_SRCD -0.070162   0.043885 -1.599 0.112966

GroupCAT2TD\_vs\_SRCD       0.007684 0.039060 0.197 0.844431

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1219 on 102 degrees of freedom

  (2 observations deleted due to missingness)

Multiple R-squared:  0.1933,    Adjusted R-squared:  0.1695

F-statistic: 8.145 on 3 and 102 DF,  p-value: 6.489e-05

**#WJ: Reading Fluency  - Linear Regression Code**

WJRFModel<-lm(WJRF\_Scaled ~ GroupCAT2, data=data) ***#First Contrasts***

summary(WJRFModel)

WJRFModel<-lm(WJRF\_Scaled ~ GroupCAT2, data=data) ***#Second Contrasts***

WJRFModel<-lm(WJRF\_Scaled ~ GroupCAT2, data=data) ***#Third Contrasts***

**#WJ: Reading Fluency - Linear Regression**

summary(WJRFModell)  ***#First Contrasts***

lm(formula = WJRF\_Scaled ~ GroupCAT2, data = data)

Residuals:

     Min       1Q Median       3Q Max

-0.33404 -0.06240  0.01596 0.08250 0.16333

Coefficients:

                       Estimate Std. Error t value Pr(>|t|)

(Intercept)             0.90750 0.02506 36.215   <2e-16 \*\*\*

**GroupCAT2DLD\_vs\_TD     -0.06346 0.02949 -2.152   0.0338 \***

GroupCAT2SRCD\_vs\_TD     0.03417 0.03641 0.938   0.3503

***GroupCAT2SRCDDLD\_vs\_TD -0.08083    0.04092 -1.975 0.0510 .***

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1121 on 98 degrees of freedom

  (6 observations deleted due to missingness)

Multiple R-squared:  0.1263,    Adjusted R-squared:  0.09953

F-statistic: 4.721 on 3 and 98 DF,  p-value: 0.004039

summary(WJRFModell)  ***#Second Contrasts***

lm(formula = WJRF\_Scaled ~ GroupCAT2, data = data)

Residuals:

     Min       1Q Median       3Q Max

-0.33404 -0.06240  0.01596 0.08250 0.16333

Coefficients:

                         Estimate Std. Error t value Pr(>|t|)

(Intercept)               0.82667 0.03235 25.553  < 2e-16 \*\*\*

GroupCAT2DLD\_vs\_SRCDDLD   0.01737 0.03589 0.484  0.62944

**GroupCAT2SRCD\_vs\_SRCDDLD  0.11500 0.04176 2.754  0.00703 \*\***

GroupCAT2TD\_vs\_SRCDDLD    0.08083 0.04092 1.975  0.05104 .

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1121 on 98 degrees of freedom

  (6 observations deleted due to missingness)

Multiple R-squared:  0.1263,    Adjusted R-squared:  0.09953

F-statistic: 4.721 on 3 and 98 DF,  p-value: 0.004039

summary(WJRFModell)  ***#Third Contrasts***

lm(formula = WJRF\_Scaled ~ GroupCAT2, data = data)

Residuals:

     Min       1Q Median       3Q Max

-0.33404 -0.06240  0.01596 0.08250 0.16333

Coefficients:

                         Estimate Std. Error t value Pr(>|t|)

(Intercept)               0.94167 0.02641 35.650  < 2e-16 \*\*\*

**GroupCAT2DLD\_vs\_SRCD     -0.09763 0.03065 -3.186  0.00194 \*\***

GroupCAT2SRCDDLD\_vs\_SRCD -0.11500    0.04176 -2.754 0.00703 \*\*

GroupCAT2TD\_vs\_SRCD      -0.03417 0.03641 -0.938  0.35034

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1121 on 98 degrees of freedom

  (6 observations deleted due to missingness)

Multiple R-squared:  0.1263,    Adjusted R-squared:  0.09953

F-statistic: 4.721 on 3 and 98 DF,  p-value: 0.004039

**#RAN Letter - Linear Regression Code**

RANletterModel<-lm(RANlet\_Scaled ~ GroupCAT2, data=data) ***#First Contrasts***

RANletterModel<-lm(RANlet\_Scaled ~ GroupCAT2, data=data) ***#Second Contrasts***

RANletterModel<-lm(RANlet\_Scaled ~ GroupCAT2, data=data) ***#Third Contrasts***

**#RAN Letter Models - Linear Regression**

summary(RANletterModel)  ***#First Contrasts***

lm(formula = RANlet\_Scaled ~ GroupCAT2, data = data)

Residuals:

    Min      1Q Median      3Q Max

-0.2191 -0.0834 -0.0190  0.0635 0.3909

Coefficients:

                       Estimate Std. Error t value Pr(>|t|)

(Intercept)             0.56150 0.02557 21.961   <2e-16 \*\*\*

GroupCAT2DLD\_vs\_TD      0.04759 0.02986 1.594    0.114

GroupCAT2SRCD\_vs\_TD    -0.01500 0.03616 -0.415    0.679

GroupCAT2SRCDDLD\_vs\_TD -0.05150    0.04074 -1.264 0.209

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1143 on 104 degrees of freedom

Multiple R-squared:  0.09238,    Adjusted R-squared:  0.0662

F-statistic: 3.528 on 3 and 104 DF,  p-value: 0.0175

summary(RANletterModel)  ***#Second Contrasts***

lm(formula = RANlet\_Scaled ~ GroupCAT2, data = data)

Residuals:

    Min      1Q Median      3Q Max

-0.2191 -0.0834 -0.0190  0.0635 0.3909

Coefficients:

                         Estimate Std. Error t value Pr(>|t|)

(Intercept)               0.51000 0.03171 16.082  < 2e-16 \*\*\*

**GroupCAT2DLD\_vs\_SRCDDLD   0.09909 0.03526 2.810  0.00592 \*\***

GroupCAT2SRCD\_vs\_SRCDDLD  0.03650 0.04074 0.896  0.37232

GroupCAT2TD\_vs\_SRCDDLD    0.05150 0.04074 1.264  0.20898

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1143 on 104 degrees of freedom

Multiple R-squared:  0.09238,    Adjusted R-squared:  0.0662

F-statistic: 3.528 on 3 and 104 DF,  p-value: 0.0175

summary(RANletterModel)  ***#Third Contrasts***

lm(formula = RANlet\_Scaled ~ GroupCAT2, data = data)

Residuals:

    Min      1Q Median      3Q Max

-0.2191 -0.0834 -0.0190  0.0635 0.3909

Coefficients:

                         Estimate Std. Error t value Pr(>|t|)

(Intercept)               0.54650 0.02557 21.374   <2e-16 \*\*\*

**GroupCAT2DLD\_vs\_SRCD      0.06259 0.02986 2.096   0.0385 \***

GroupCAT2SRCDDLD\_vs\_SRCD -0.03650    0.04074 -0.896 0.3723

GroupCAT2TD\_vs\_SRCD       0.01500 0.03616 0.415   0.6791

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1143 on 104 degrees of freedom

Multiple R-squared:  0.09238,    Adjusted R-squared:  0.0662

F-statistic: 3.528 on 3 and 104 DF,  p-value: 0.0175

**#RAN 2-set - Linear Regression Code**

RAN2setModel<-lm(RAN2set\_Scaled ~ GroupCAT2, data=data) ***#First Contrasts***

RAN2setModel<-lm(RAN2set\_Scaled ~ GroupCAT2, data=data) ***#Second Contrasts***

RAN2setModel<-lm(RAN2set\_Scaled ~ GroupCAT2, data=data) ***#Third Contrasts***

**#RAN 2-set Models - Linear Regression**

summary(RAN2setModel)  ***#First Contrasts***

lm(formula = RAN2set\_Scaled ~ GroupCAT2, data = data)

Residuals:

    Min      1Q Median      3Q Max

-0.2680 -0.0785 -0.0180  0.0615 0.3720

Coefficients:

                       Estimate Std. Error t value Pr(>|t|)

(Intercept)             0.58200 0.02653 21.939   <2e-16 \*\*\*

GroupCAT2DLD\_vs\_TD      0.04600 0.03098 1.485    0.141

GroupCAT2SRCD\_vs\_TD    -0.02200 0.03752 -0.586    0.559

GroupCAT2SRCDDLD\_vs\_TD -0.01046    0.04227 -0.248 0.805

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1186 on 104 degrees of freedom

Multiple R-squared:  0.05921,    Adjusted R-squared:  0.03208

F-statistic: 2.182 on 3 and 104 DF,  p-value: 0.09459

summary(RAN2setModel)  ***#Second Contrasts***

lm(formula = RAN2set\_Scaled ~ GroupCAT2, data = data)

Residuals:

    Min      1Q Median      3Q Max

-0.2680 -0.0785 -0.0180  0.0615 0.3720

Coefficients:

                         Estimate Std. Error t value Pr(>|t|)

(Intercept)               0.57154 0.03290 17.370   <2e-16 \*\*\*

GroupCAT2DLD\_vs\_SRCDDLD   0.05646 0.03659 1.543    0.126

GroupCAT2SRCD\_vs\_SRCDDLD -0.01154    0.04227 -0.273 0.785

GroupCAT2TD\_vs\_SRCDDLD    0.01046 0.04227 0.248    0.805

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1186 on 104 degrees of freedom

Multiple R-squared:  0.05921,    Adjusted R-squared:  0.03208

F-statistic: 2.182 on 3 and 104 DF,  p-value: 0.09459

summary(RAN2setModel)  ***#Third Contrasts***

lm(formula = RAN2set\_Scaled ~ GroupCAT2, data = data)

Residuals:

    Min      1Q Median      3Q Max

-0.2680 -0.0785 -0.0180  0.0615 0.3720

Coefficients:

                         Estimate Std. Error t value Pr(>|t|)

(Intercept)               0.56000 0.02653 21.110   <2e-16 \*\*\*

**GroupCAT2DLD\_vs\_SRCD      0.06800 0.03098 2.195   0.0304 \***

GroupCAT2SRCDDLD\_vs\_SRCD  0.01154 0.04227 0.273   0.7854

GroupCAT2TD\_vs\_SRCD       0.02200 0.03752 0.586   0.5589

---

Signif. codes:  0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1186 on 104 degrees of freedom

Multiple R-squared:  0.05921,    Adjusted R-squared:  0.03208

F-statistic: 2.182 on 3 and 104 DF,  p-value: 0.09459

**#R Packages for Figures**

library(ggplot2), library(tidyr), library(plyr)

**#R Data Restructure for Figures**

#remove the non-significant data assessments

predata<-data[c(-17,-18,-19,-24)]

#reshape the data from wide to long format

data\_long <- gather(predata, Assessment, ScaledScore, predata$Elision\_Scaled:predata$WJRF\_Scaled, factor\_key=TRUE)

View(data\_long)

**#R Data Rename for Figures**

pg <- data\_long # Copy data into new data frame

# Rename the column and the values in the factor

levels(pg$Assessment)[levels(pg$Assessment)=="Elision\_Scaled"] <- "Elision"

levels(pg$Assessment)[levels(pg$Assessment)=="RANlet\_Scaled"] <- "RAN Letter"

levels(pg$Assessment)[levels(pg$Assessment)=="RAN2set\_Scaled"] <- "RAN 2-set"

levels(pg$Assessment)[levels(pg$Assessment)=="DSF\_Scaled"] <- "DigitSpan Forward"

levels(pg$Assessment)[levels(pg$Assessment)=="DSB\_Scaled"] <- "DigitSpan Backward"

levels(pg$Assessment)[levels(pg$Assessment)=="WJRF\_Scaled"] <- "Reading Fluency"

names(pg)[names(pg)=="ScaledScore"] <- "Scaled Score"

**#R ggplot2 Code for Figure 1** **(Color)**

ggplot(pg, aes(Assessment, `Scaled Score`, fill = GroupCAT2), labeller=variable\_labeller) +

stat\_summary(geom = "bar", fun.y = mean, position = "dodge") +

stat\_summary(geom = "errorbar", fun.data = mean\_se, position=position\_dodge(width=0.90), width = 0.2) + scale\_fill\_brewer(palette="Paired") + theme\_classic(base\_size = 16) + guides(fill=guide\_legend(title=NULL)) + theme(legend.position="top")

**#R ggplot2 Code for Figure 1** **(Grey)**

ggplot(pg, aes(Assessment, `Scaled Score`, fill = GroupCAT2), labeller=variable\_labeller) +

stat\_summary(geom = "bar", fun.y = mean, position = "dodge") +

stat\_summary(geom = "errorbar", fun.data = mean\_se, position=position\_dodge(width=0.90), width = 0.2) + scale\_fill\_brewer(palette="Greys") + theme\_classic(base\_size = 16) + guides(fill=guide\_legend(title=NULL)) + theme(legend.position="top")