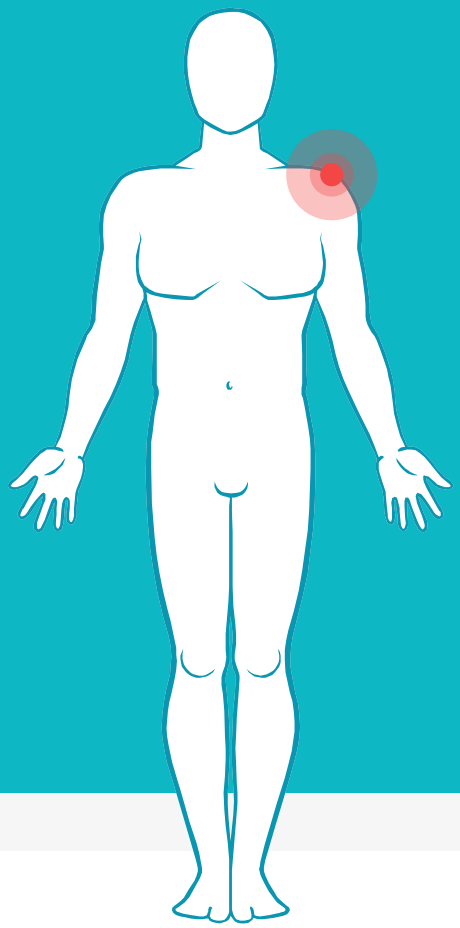
Data Analysis iWear & APDM

Xueyao Li

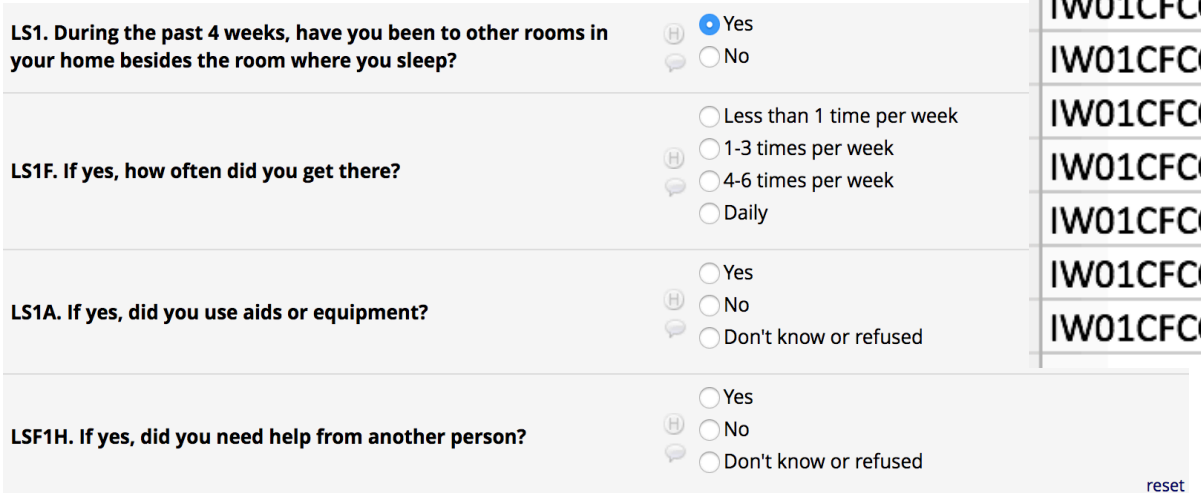


1. iWear

Data Cleaning

- 78 participants & 537 variables
- 5 sites
- Logical questions

record	field
A-Y	bi_height
A-Y	motor_chorea_face
A-Y	sdm_correct
A-Y	sdm_errors
IW01CFCO	bi_birthdate
IW01CFCO	mwd
IW01CFCO	motor_ocular_horiz
IW01CFCO	motor_ocular_vert
IW01CFCO	motor_sacc_int_horiz
IW01CFCO	saccade_int_vert
IW01CFCO	motor_sacc_veloc_horiz
IW01CFCO	motor_sacc_veloc_vert
IW01CFCO	motor_dysarthria
IW01CFCO	motor_tongue
IW01CFCO	motor_finger_right



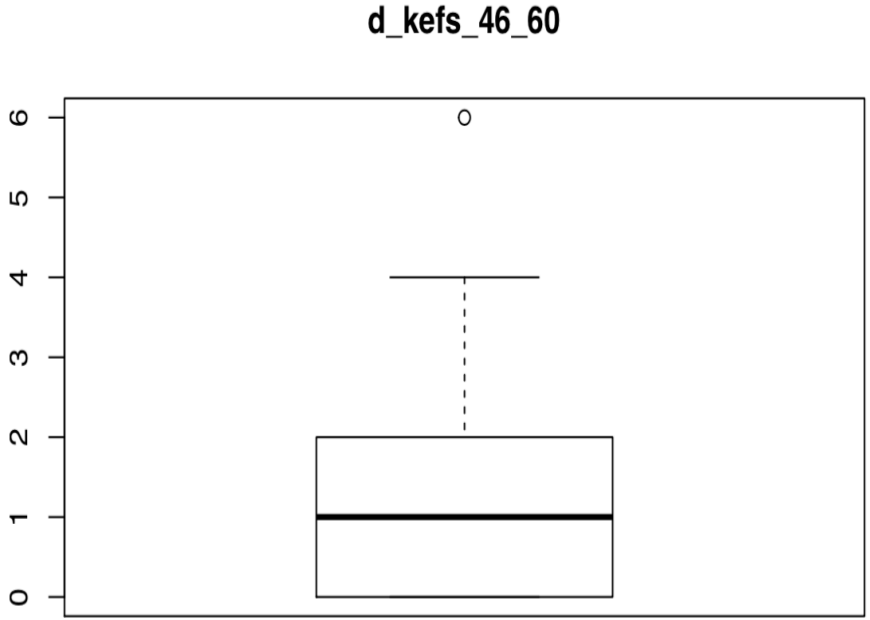
Outlier Analysis

```
is_outlier <- function(x) {
  return( x < quantile(x, 0.25, na.rm = T) - 1.5 * IQR(x, na.rm = T) |
          x > quantile(x, 0.75, na.rm = T) + 1.5 * IQR(x, na.rm = T))
}

for (i in numList){
  #box-and-whisker plot
  boxplot(df[,i], main=i)

  #summary
  cat(i, "summary: \n")
  print(summary(df[,i]))
  cat("\n")

  #identify outliers
  cat(i, "outliers: \n")
  outlier <- ifelse(is_outlier(df[,i]), df[,i], as.numeric(NA))
  names(outlier) <- df$as_correct
  df_out <- as.data.frame(outlier)
  df_out <- na.omit(df_out)
  print(df_out)
}
```




```
## d_kefs_46_60 summary:
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
##   0.000   0.000   1.000   1.519   2.000   6.000       1
##
## d_kefs_46_60 outliers:
##         outlier
## IW6TCCO       6
```

5

Calculation

IPAQ – Pre/Post

Participant ID	IPAQ-SF Responses (ENTER RAW DATA HERE)						
	Vigorous Activity		Moderate Activity		Walking Activity		Sitting
	Days Q1	Min Q2	Days Q3	Min Q4	Days Q5	Min Q6	Hours Q7
A-Y	6	30	1	30	7	45	7
IW01CFCO	4	30	7	60	7	60	5
IW02CFCO	0	0	1	60	6	120	5

IPAQ-SF Final MET-Minutes and Categorical Scores							
TOTAL DAYS OF ACTIVITY		TOTAL ACTIVITY (min/wk)		MET-MINUTES PER WEEK			
Days	Days (Recoded)	(Self-Reported)	(Truncated)	Vigorous	Moderate	Walk	Total
14	7	105	105	1440	120	1039.5	2600
18	7	150	150	960	1680	1386	4026
7	7	180	180	0	240	2376	2616

Lifespace

Name: Date:

These questions refer to your activities just within the past month.

LIFE-SPACE LEVEL			FREQUENCY				INDEPENDENCE	SCORE
During the past four weeks, have you been to . . .			How often did you get there?				Did you use aids or equipment? Did you need help from another person?	Level X Frequency X Independence
Life-Space Level 1. . . **Other rooms of your home besides the room where you sleep?**	Yes 1	No 0	Less than 1 /week 1	1-3 times /week 2	4-6 times /week 3	Daily 4	1 = Personal assistance 1.5 = Equipment only 2 = No equipment or personal assistance	
Score	1	X	4		X	1.5	=	6 *Level 1 Score*
Life-Space Level 2. . . **An area outside your home such as your porch, deck or patio, hallway (of an apartment building) or garage, in your own yard or driveway?**	Yes 2	No 0	Less than 1 /week 1	1-3 times /week 2	4-6 times /week 3	Daily 4	1 = Personal assistance 1.5 = Equipment only 2 = No equipment or personal assistance	
Score	2	X	4		X	1.5	=	12 *Level 2 Score*
Life-Space Level 3. . . **Places in your neighborhood, other than your own yard or apartment building?**	Yes 3	No 0	Less than 1 /week 1	1-3 times /week 2	4-6 times /week 3	Daily 4	1 = Personal assistance 1.5 = Equipment only 2 = No equipment or personal assistance	
Score	3	X	2		X	1.5	=	9 *Level 3 Score*
Life-Space Level 4. . . **Places outside your neighborhood, but within your town?**	Yes 4	No 0	Less than 1 /week 1	1-3 times /week 2	4-6 times /week 3	Daily 4	1 = Personal assistance 1.5 = Equipment only 2 = No equipment or personal assistance	
Score	4	X	2		X	1	=	8 *Level 4 Score*
Life-Space Level 5. . . **Places outside your town?**	Yes 5	No 0	Less than 1 /week 1	1-3 times /week 2	4-6 times /week 3	Daily 4	1 = Personal assistance 1.5 = Equipment only 2 = No equipment or personal assistance	
Score	0	X			X		=	0 *Level 5 Score*
							TOTAL SCORE (ADD)	35 *Sum of Levels*

Figure 2.
Example of scoring of the Life-Space Assessment. The subject traveled to all levels (levels 1–4) except for out of town (level 5); traveled daily to levels 1 and 2, and traveled 1 to 3 times each week to levels 3 and 4; uses a cane at all times and requires assistance with driving.

2. APDM

Data Integration

- 20170928-061941_Walk_trial.csv
- 20170928-062558_Sit to Stand_trial.csv
- 20170928-063130_Sway_trial.csv
- 20170928-063354_Sway_trial.csv
- 20170928-063539_Sway_trial.csv
- 20170928-063718_Sway_trial.csv
- 20170928-063842_Sway_trial.csv
- 20170928-064015_Sway_trial.csv
- 20170928-064503_TUG_trial.csv
- 20170928-064548_TUGw/co_trial.csv
- 20170928-064703_Walk_trial.csv
- 20170928-064808_WalkAlphabet_trial.csv
- 20170928-064849_WalkEOLetter_trial.csv
- 20170928-064957_WalkDKEFS_trial.csv
- 20170928-065127_Walking (iWear)_trial.csv
- rawData

CSV.4 | Subject Group	iWear		
Subject Public ID	GH1		
Record Date	20170928-064703		
Condition	Open Ended		
File Name	20170928-124703_Walking__iWear_.h5		
Trial Notes			
Analysis Log	Warning::Algorithm for estimating sensc		
Analysis Version	3		
Measure	Normative M	Normative St	Mean
Anticipatory Postural Adjustment - APA Duration (s)	0.51	0.26	
Anticipatory Postural Adjustment - First Step Duration (s)	0.52	0.05	
Anticipatory Postural Adjustment - First Step Range of Motion (degrees)	33.17	9.49	
Anticipatory Postural Adjustment - Forward APA Peak (m/s^2)	0.52	0.28	
Anticipatory Postural Adjustment - Lateral APA Peak (m/s^2)	0.44	0.2	
Duration (s)			16.87
Gait - Lower Limb - Cadence L (steps/min)	116.71	9.14	109.88
Gait - Lower Limb - Cadence R (steps/min)	116.71	9.14	108.57
Gait - Lower Limb - Double Support L (%GCT)	18.31	3.56	20.8
Gait - Lower Limb - Double Support R (%GCT)	18.31	3.56	20.89
Gait - Lower Limb - Elevation at Midswing L (cm)	1.27	0.6	0.41
Gait - Lower Limb - Elevation at Midswing R (cm)	1.27	0.6	1.89
Gait - Lower Limb - Gait Cycle Duration L (s)	1.04	0.09	1.1
Gait - Lower Limb - Gait Cycle Duration R (s)	1.04	0.09	1.11
Gait - Lower Limb - Gait Speed L (m/s)	1.36	0.18	1.22
Gait - Lower Limb - Gait Speed R (m/s)	1.36	0.18	1.2

Condition	Walk Duration	Walk Gait Speed L	Walk Gait Speed R	Alphabet Duration	Alphabet Gait Speed L	Alphabet Gait Speed R	EOL Duration	EOL Gait Spe	EOL Gait Speed R
GH1	16.87	1.22	1.2	15.91	1.09	1.05	18.3	1.01	1.02
GH10	8.11	1.01	0.94	8.58	0.95	0.91	11.17	0.69	0.66
GH11	6.71	1.26	1.26	7.31	1.19	1.2	7.99	1.09	1.05
GH12	8.34	1.18	1.11	7.96	1.23	1.22	9.2	NA	NA
GH13	8.81	1.13	1.08	8.81	1.05	0.95	19.74	0.82	0.77
GH14	7.91	1.35	1.25	20.11	0.61	0.54	37.84	0.22	0.32
GH15	16.04	0.5	0.49	20.63	0.38	0.37	23.3	0.35	0.33
GH16	7.98	1.42	1.32	8.01	1.16	1.15	7.41	1.08	1
GH17	10.35	0.84	0.84	10.93	0.77	0.77	16.59	NA	NA

3. Dual Task

To examine the relative contributions of participant characteristics and motor and cognitive factors to the ability to walk while performing cognitive tasks.

”

Process

Cognitive: Correct Response Rate
Motor: Gait Speed, Sway Area, Duration

DTE

ANOVA

DTE

$$\text{DTE}(\%) = \frac{dual - single}{single}$$

For variables in which larger values indicate worse performance (e.g., sway area, duration),

$$\text{DTE}(\%) = - \frac{dual - single}{single}$$

SWAY			HD	Control
	standing feet apart	single		
		dual task		
	standing feet together	single		
		dual task		
	standing foam	single		
		dual task		
GAIT SPEED			HD	Control
(L+R)/2	walking 7m			
	alphabet			
	every other			
DURATION			HD	Control
	TUG (gait speed)			
	TUG cognitive (gait speed)			
COGNITIVE			HD	Control
	standing feet apart	single		
		dual task		
	standing feet together	single		
		dual task		
	standing foam	single		
		dual task		
COGNITIVE			HD	Control
	walking 7m			
	alphabet			
	every other			

Cognitive - Standing

```
#cognitive-standing
#single task
##interference
dte <- df[,c("as_correct","stroop_it_correct","stroop_it_errors")]
dte$it_crr <- dte$stroop_it_correct/45

#dual task
##faeofs
dte$faeofs_correct <- df$stroop_correct
dte$faeofs_errors <- df$stroop_errors
dte$faeofs_crr <- dte$faeofs_correct/45
dte$faeofs_dte <- 100 * (dte$faeofs_crr - dte$it_crr)/dte$it_crr
```

Cognitive - Walking

```
#cognitive-walking
#single task: alphabet sitting
as <- grep("as", fields)[c(1,24:29)]
df_as <- df[,as]
dte <- merge(dte, df_as)
as_crr <- (dte$as_correct1 - dte$as_errors)/dte$as_time
dte <- add_column(dte, as_crr, .after="as_errors")
dte$as_eol_crr <- (as.numeric(dte$as_eol_correct) - dte$as_eol_errors)/dte$as_eol_time

##Walking While Talking (Alphabet)
wwt_time <- df_apdm$Alphabet.Duration[match(dte$as_correct,df_apdm$as_correct)]
dte <- add_column(dte, wwt_time, .after="wwt_errors")
wwt_crr <- (dte$wwt_correct - dte$wwt_errors)/dte$wwt_time
dte <- add_column(dte, wwt_crr, .after="wwt_time")
wwt_dte <- 100 * (dte$wwt_crr - dte$as_crr)/dte$as_crr
dte <- add_column(dte, wwt_dte, .after="wwt_crr")
```

Illustration of conceptual model for characterizing patterns of cognitive-motor dual-task interference.

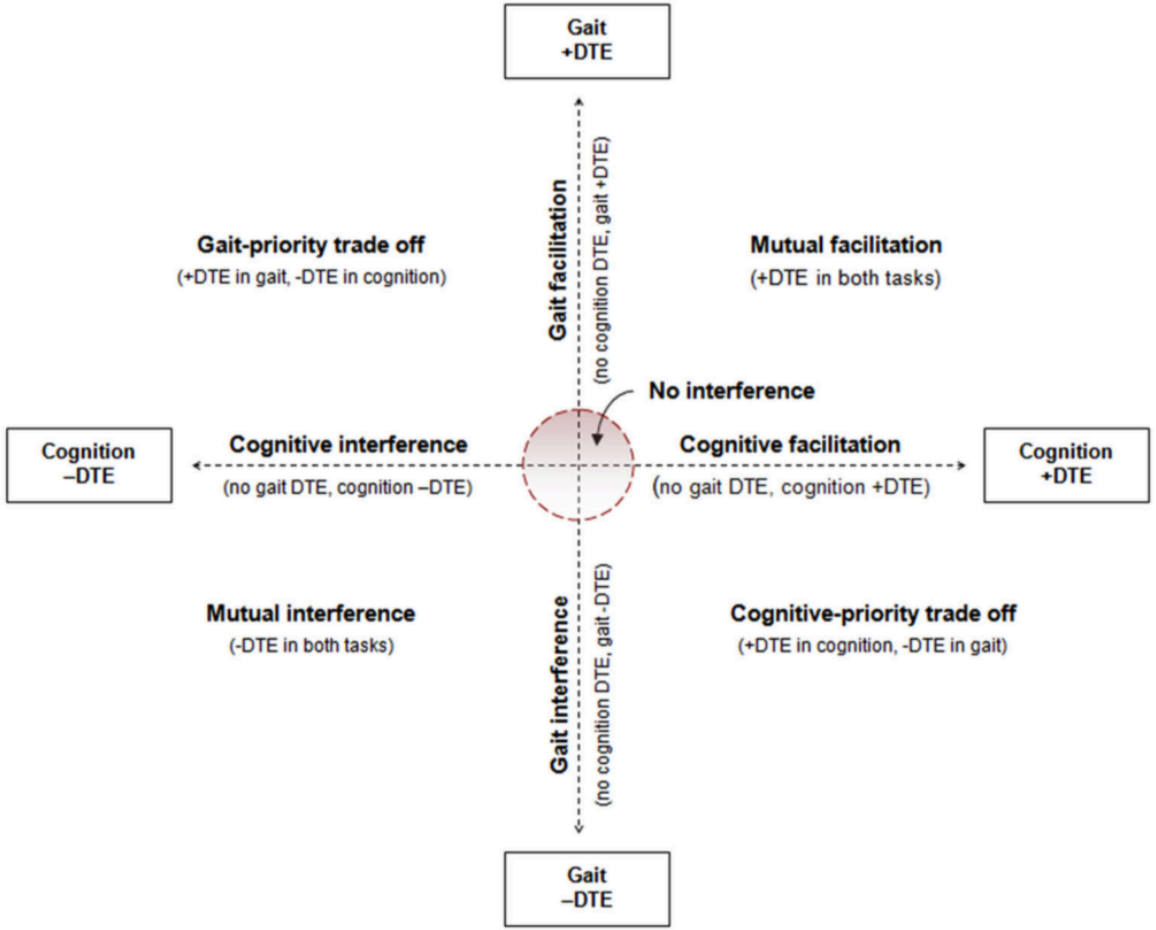
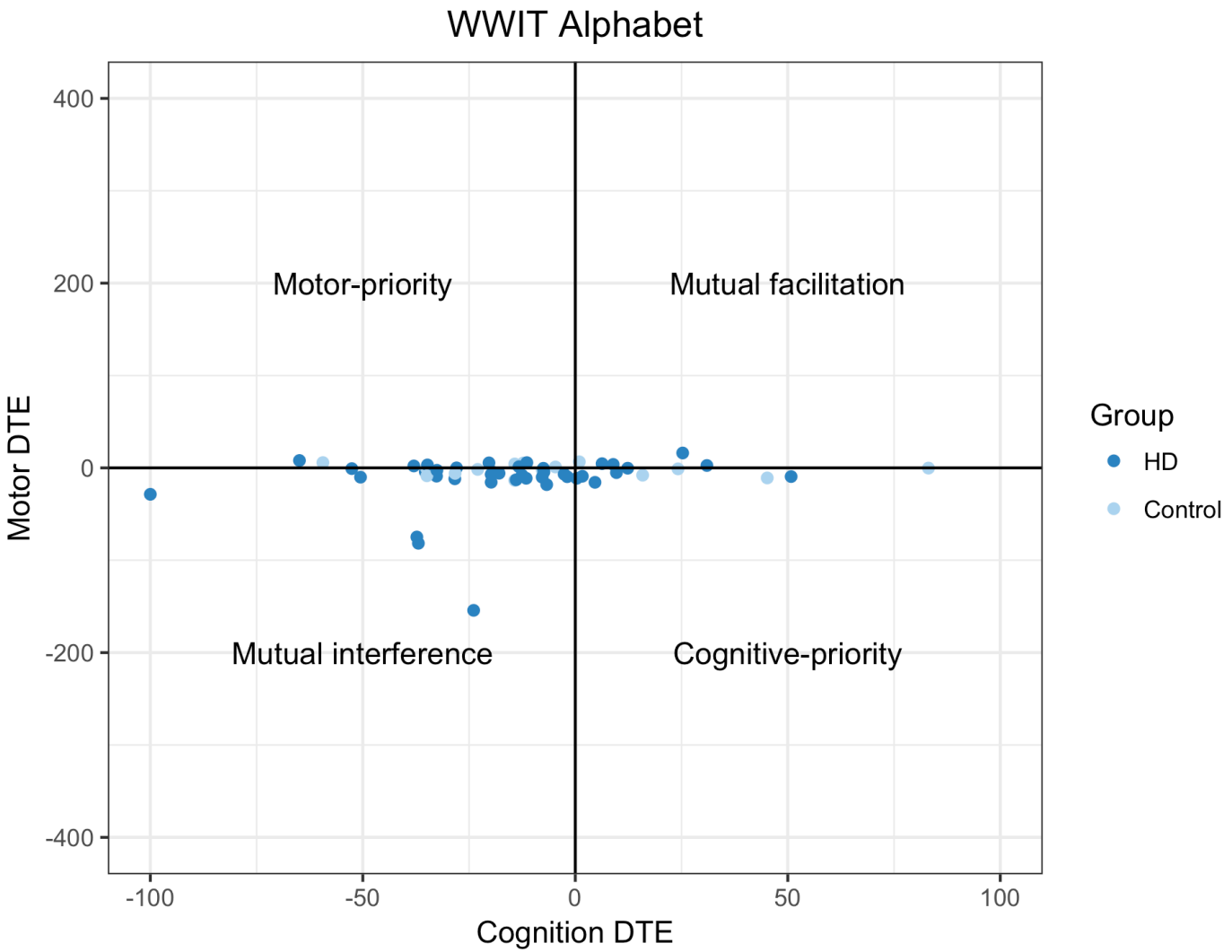


FIGURE 1 | Illustration of conceptual model for characterizing patterns of cognitive-motor dual-task interference. Figure is from Plummer et al. (201
and adapted from conceptual framework of Plummer et al. (2013).


WWIT Alphabet
Motor-priority
Mutual facilitation
Mutual interference
Cognitive-priority
Motor DTE
Cognition DTE
400
200
0
-200
-400
-100
-50
0
50
100
Group
HD
Control

THANKS!

Any questions?