

```
data<-read.table("y:/research/FAST/Participant_Responses/stats/np-  
anovalike/CodingQs-for-R-npar.csv", sep="," , header=TRUE)
```

```
dev.off()
```

```
windows.options(width=6,height=5)
```

```
boxplot(data$Q1[data$Condition=='Out Adaptive' &  
data$Direction=='Out'], data$Q1[data$Condition=='Return Adaptive' &  
data$Direction=='Out'], data$Q1[data$Condition=='Out Adaptive' &  
data$Direction=='Return'], data$Q1[data$Condition=='Return Adaptive' &  
data$Direction=='Return'], names=list('Out/Adapt', 'Out/Fixed', 'Return/Fixed'  
, 'Return/Adapt'), ylab='Q1: I enjoyed the  
walk', xlab='Direction/Treatment', boxwex=0.7, ylim = c(1,7))
```

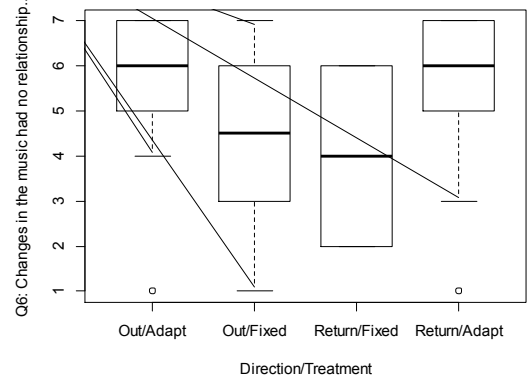
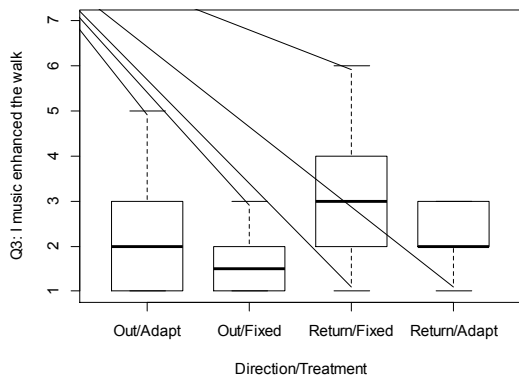
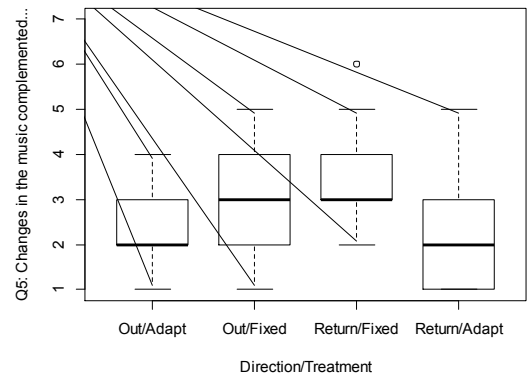
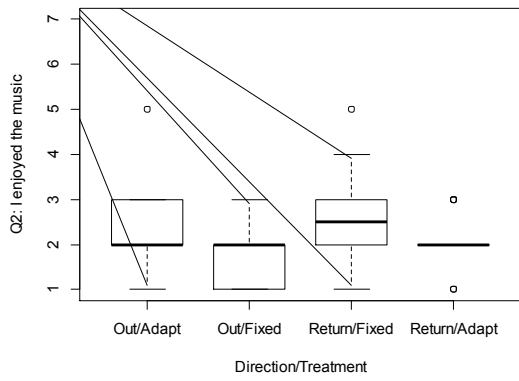
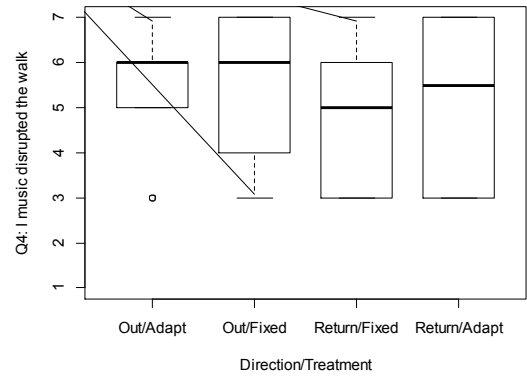
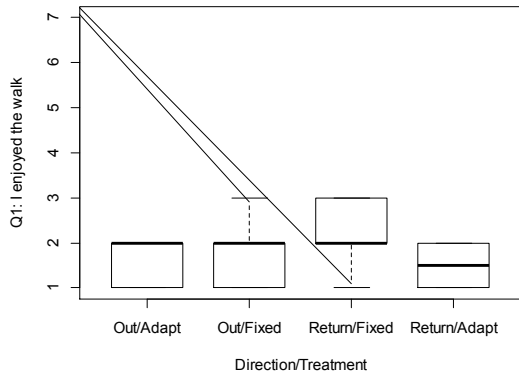
```
boxplot(data$Q2[data$Condition=='Out Adaptive' &  
data$Direction=='Out'], data$Q2[data$Condition=='Return Adaptive' &  
data$Direction=='Out'], data$Q2[data$Condition=='Out Adaptive' &  
data$Direction=='Return'], data$Q2[data$Condition=='Return Adaptive' &  
data$Direction=='Return'], names=list('Out/Adapt', 'Out/Fixed', 'Return/Fixed'  
, 'Return/Adapt'), ylab='Q2: I enjoyed the  
music', xlab='Direction/Treatment', boxwex=0.7, ylim = c(1,7))
```

```
boxplot(data$Q3[data$Condition=='Out Adaptive' &  
data$Direction=='Out'], data$Q3[data$Condition=='Return Adaptive' &  
data$Direction=='Out'], data$Q3[data$Condition=='Out Adaptive' &  
data$Direction=='Return'], data$Q3[data$Condition=='Return Adaptive' &  
data$Direction=='Return'], names=list('Out/Adapt', 'Out/Fixed', 'Return/Fixed'  
, 'Return/Adapt'), ylab='Q3: I music enhanced the  
walk', xlab='Direction/Treatment', boxwex=0.7, ylim = c(1,7))
```

```
boxplot(data$Q4[data$Condition=='Out Adaptive' &  
data$Direction=='Out'], data$Q4[data$Condition=='Return Adaptive' &  
data$Direction=='Out'], data$Q4[data$Condition=='Out Adaptive' &  
data$Direction=='Return'], data$Q4[data$Condition=='Return Adaptive' &  
data$Direction=='Return'], names=list('Out/Adapt', 'Out/Fixed', 'Return/Fixed'  
, 'Return/Adapt'), ylab='Q4: I music disrupted the  
walk', xlab='Direction/Treatment', boxwex=0.7, ylim = c(1,7))
```

```
boxplot(data$Q5[data$Condition=='Out Adaptive' &  
data$Direction=='Out'], data$Q5[data$Condition=='Return Adaptive' &  
data$Direction=='Out'], data$Q5[data$Condition=='Out Adaptive' &  
data$Direction=='Return'], data$Q5[data$Condition=='Return Adaptive' &  
data$Direction=='Return'], names=list('Out/Adapt', 'Out/Fixed', 'Return/Fixed'  
, 'Return/Adapt'), ylab='Q5: Changes in the music  
complemented...', xlab='Direction/Treatment', boxwex=0.7, ylim = c(1,7))
```

```
boxplot(data$Q6[data$Condition=='Out Adaptive' &  
data$Direction=='Out'], data$Q6[data$Condition=='Return Adaptive' &  
data$Direction=='Out'], data$Q6[data$Condition=='Out Adaptive' &  
data$Direction=='Return'], data$Q6[data$Condition=='Return Adaptive' &  
data$Direction=='Return'], names=list('Out/Adapt', 'Out/Fixed', 'Return/Fixed'  
, 'Return/Adapt'), ylab='Q6: Changes in the music had no  
relationship...', xlab='Direction/Treatment', boxwex=0.7, ylim = c(1,7))
```



nparLD <https://cran.r-project.org/web/packages/nparLD/nparLD.pdf>  
See <http://dmrussell.net/CHI2010/docs/p2391.pdf>  
Powerful and Consistent Analysis of Likert-Type Rating Scales (CHI 2010)

(install & load package nparLD)

```
q1<-nparLD( Q1 ~ Direction * Condition, data=data, 'P' )
```

```
Total number of observations: 56  
Total number of subjects: 28  
Total number of missing observations: 0
```

Class level information

-----

```
Levels of Direction (sub-plot factor time) : 2  
Levels of Condition (whole-plot factor group) : 2
```

Abbreviations

-----

```
RankMeans = Rank means  
Nobs = Number of observations  
RTE = Relative treatment effect  
case2x2 = tests for 2-by-2 design  
Wald.test = Wald-type test statistic  
ANOVA.test = ANOVA-type test statistic with Box approximation  
ANOVA.test.mod.Box = modified ANOVA-type test statistic with Box  
approximation  
Wald.test.time = Wald-type test statistic for simple time effect  
ANOVA.test.time = ANOVA-type test statistic for simple time effect  
N = Standard Normal Distribution N(0,1)  
T = Student's T distribution with respective degrees of freedom  
pattern.time (time effects) = Test against patterned alternatives in time  
using normal distribution ( no pattern specified )  
pair.comparison = Tests for pairwise comparisons (without specifying a  
pattern)  
pattern.pair.comparison = Test for pairwise comparisons with patterned  
alternatives in time ( no pattern specified )  
pattern.group (group effects) = Test against patterned alternatives in  
group ( no pattern specified )  
covariance = Covariance matrix  
Note: The description output above will disappear by setting  
description=FALSE in the input. See the help file for details.
```

F1 LD F1 Model

-----

```
Check that the order of the time and group levels are correct.  
Time level: Out Return  
Group level: Return Adaptive Out Adaptive  
If the order is not correct, specify the correct order in time.order or  
group.order.
```

```
>summary(q1)
```

```
Model:  
F1 LD F1 Model
```

Call:  
Q1 ~ Direction \* Condition

Relative Treatment Effect (RTE):

	RankMeans	Nobs	RTE
ConditionReturn Adaptive	24.05357	28	0.4205995
ConditionOut Adaptive	32.94643	28	0.5794005
DirectionOut	26.73214	28	0.4684311
DirectionReturn	30.26786	28	0.5315689
ConditionReturn Adaptive:DirectionOut	25.60714	14	0.4483418
ConditionReturn Adaptive:DirectionReturn	22.50000	14	0.3928571
ConditionOut Adaptive:DirectionOut	27.85714	14	0.4885204
ConditionOut Adaptive:DirectionReturn	38.03571	14	0.6702806

Wald-Type Statistic (WTS):

	Statistic	df	p-value
Condition	5.058114	1	0.02451090
Direction	1.145795	1	0.28443109
Condition:Direction	4.044478	1	0.04431608

ANOVA-Type Statistic (ATS):

	Statistic	df	p-value
Condition	5.058114	1	0.02451090
Direction	1.145795	1	0.28443109
Condition:Direction	4.044478	1	0.04431608

Modified ANOVA-Type Statistic for the Whole-Plot Factors:

	Statistic	df1	df2	p-value
Condition	5.058114	1	25.98405	0.03321096

**windows.options (width=4,height=6)**

**plot(q1)**

**title(main="Q1**

**",ylab="Relative**

**Effects")**

```

q2<-nparLD( Q2 ~ Direction * Condition, data=data, 'P' )
summary(q2)
plot(q2)
title(main="Q2                               ",ylab="Relative
Effects")

```

```

Total number of observations:  56
Total number of subjects:    28
Total number of missing observations:  0

```

Class level information

-----

```

Levels of Direction (sub-plot factor time) :  2
Levels of Condition (whole-plot factor group) :  2

```

Abbreviations

-----

```

RankMeans = Rank means
Nobs = Number of observations
RTE = Relative treatment effect
case2x2 = tests for 2-by-2 design
Wald.test = Wald-type test statistic
ANOVA.test = ANOVA-type test statistic with Box approximation
ANOVA.test.mod.Box = modified ANOVA-type test statistic with Box
approximation
Wald.test.time = Wald-type test statistic for simple time effect
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N = Standard Normal Distribution N(0,1)
T = Student's T distribution with respective degrees of freedom
pattern.time (time effects) = Test against patterned alternatives in time
using normal distribution ( no pattern specified )
pair.comparison = Tests for pairwise comparisons (without specifying a
pattern)
pattern.pair.comparison = Test for pairwise comparisons with patterned
alternatives in time ( no pattern specified )
pattern.group (group effects) = Test against patterned alternatives in
group ( no pattern specified )
covariance = Covariance matrix
Note: The description output above will disappear by setting
description=FALSE in the input. See the help file for details.

```

F1 LD F1 Model

-----

```

Check that the order of the time and group levels are correct.
Time level:   Out Return
Group level:  Return Adaptive Out Adaptive
If the order is not correct, specify the correct order in time.order or
group.order.

```

Model:

F1 LD F1 Model

Call:

Q2 ~ Direction \* Condition

Relative Treatment Effect (RTE):

	RankMeans	Nobs	RTE
ConditionReturn Adaptive	24.37500	28	0.4263393
ConditionOut Adaptive	32.62500	28	0.5736607
DirectionOut	25.50000	28	0.4464286
DirectionReturn	31.50000	28	0.5535714
ConditionReturn Adaptive:DirectionOut	21.53571	14	0.3756378
ConditionReturn Adaptive:DirectionReturn	27.21429	14	0.4770408
ConditionOut Adaptive:DirectionOut	29.46429	14	0.5172194
ConditionOut Adaptive:DirectionReturn	35.78571	14	0.6301020

Wald-Type Statistic (WTS):

	Statistic	df	p-value
Condition	3.20506476	1	0.07341060
Direction	3.99901908	1	0.04552675
Condition:Direction	0.01147678	1	0.91468607

ANOVA-Type Statistic (ATS):

	Statistic	df	p-value
Condition	3.20506476	1	0.07341060
Direction	3.99901908	1	0.04552675
Condition:Direction	0.01147678	1	0.91468607

Modified ANOVA-Type Statistic for the Whole-Plot Factors:

	Statistic	df1	df2	p-value
Condition	3.205065	1	23.99904	0.08603608

```

q3<-nparLD( Q3 ~ Direction * Condition, data=data, 'P' )
summary(q3)
plot(q3)
title(main="Q3                                     ",ylab="Relative
Effects")
Total number of observations:  56
Total number of subjects:    28
Total number of missing observations:  0

Class level information
-----
Levels of Direction (sub-plot factor time) :  2
Levels of Condition (whole-plot factor group) :  2

Abbreviations
-----
RankMeans = Rank means
Nobs = Number of observations
RTE = Relative treatment effect
case2x2 = tests for 2-by-2 design
Wald.test = Wald-type test statistic
ANOVA.test = ANOVA-type test statistic with Box approximation
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approximation
Wald.test.time = Wald-type test statistic for simple time effect
ANOVA.test.time = ANOVA-type test statistic for simple time effect
N = Standard Normal Distribution N(0,1)
T = Student's T distribution with respective degrees of freedom
pattern.time (time effects) = Test against patterned alternatives in time
using normal distribution ( no pattern specified )
pair.comparison = Tests for pairwise comparisons (without specifying a
pattern)
pattern.pair.comparison = Test for pairwise comparisons with patterned
alternatives in time ( no pattern specified )
pattern.group (group effects) = Test against patterned alternatives in
group ( no pattern specified )
covariance = Covariance matrix
Note: The description output above will disappear by setting
description=FALSE in the input. See the help file for details.

F1 LD F1 Model
-----
Check that the order of the time and group levels are correct.
Time level:   Out Return
Group level:  Return Adaptive Out Adaptive
If the order is not correct, specify the correct order in time.order or
group.order.

> summary(q3)
Model:
F1 LD F1 Model

Call:

```

Q3 ~ Direction \* Condition

Relative Treatment Effect (RTE):

	RankMeans	Nobs	RTE
ConditionReturn Adaptive	24.69643	28	0.4320791
ConditionOut Adaptive	32.30357	28	0.5679209
DirectionOut	24.00000	28	0.4196429
DirectionReturn	33.00000	28	0.5803571
ConditionReturn Adaptive:DirectionOut	18.96429	14	0.3297194
ConditionReturn Adaptive:DirectionReturn	30.42857	14	0.5344388
ConditionOut Adaptive:DirectionOut	29.03571	14	0.5095663
ConditionOut Adaptive:DirectionReturn	35.57143	14	0.6262755

Wald-Type Statistic (WTS):

	Statistic	df	p-value
Condition	2.7419856	1	0.097743244
Direction	8.1352405	1	0.004341309
Condition:Direction	0.6099124	1	0.434820778

ANOVA-Type Statistic (ATS):

	Statistic	df	p-value
Condition	2.7419856	1	0.097743244
Direction	8.1352405	1	0.004341309
Condition:Direction	0.6099124	1	0.434820778

Modified ANOVA-Type Statistic for the Whole-Plot Factors:

	Statistic	df1	df2	p-value
Condition	2.741986	1	22.34892	0.1117187



```
q4<-nparLD( Q4 ~ Direction * Condition, data=data, 'P' )
summary(q4)
plot(q4)
title(main="Q4", ylab="Relative Effects")
```

Total number of observations: 56  
Total number of subjects: 28  
Total number of missing observations: 0

Class level information  
-----

Levels of Direction (sub-plot factor time) : 2  
Levels of Condition (whole-plot factor group) : 2

Abbreviations  
-----

RankMeans = Rank means  
Nobs = Number of observations  
RTE = Relative treatment effect  
case2x2 = tests for 2-by-2 design  
Wald.test = Wald-type test statistic  
ANOVA.test = ANOVA-type test statistic with Box approximation  
ANOVA.test.mod.Box = modified ANOVA-type test statistic with Box approximation  
Wald.test.time = Wald-type test statistic for simple time effect  
ANOVA.test.time = ANOVA-type test statistic for simple time effect  
N = Standard Normal Distribution N(0,1)  
T = Student's T distribution with respective degrees of freedom  
pattern.time (time effects) = Test against patterned alternatives in time using normal distribution ( no pattern specified )  
pair.comparison = Tests for pairwise comparisons (without specifying a pattern)  
pattern.pair.comparison = Test for pairwise comparisons with patterned alternatives in time ( no pattern specified )  
pattern.group (group effects) = Test against patterned alternatives in group ( no pattern specified )  
covariance = Covariance matrix  
Note: The description output above will disappear by setting description=FALSE in the input. See the help file for details.

F1 LD F1 Model  
-----

Check that the order of the time and group levels are correct.  
Time level: Out Return  
Group level: Return Adaptive Out Adaptive  
If the order is not correct, specify the correct order in time.order or group.order.

```
> summary(q4)
Model:
F1 LD F1 Model
```

Call:  
Q4 ~ Direction \* Condition

Relative Treatment Effect (RTE):

	RankMeans	Nobs	RTE
ConditionReturn Adaptive	30.55357	28	0.5366709
ConditionOut Adaptive	26.44643	28	0.4633291
DirectionOut	31.98214	28	0.5621811
DirectionReturn	25.01786	28	0.4378189
ConditionReturn Adaptive:DirectionOut	34.03571	14	0.5988520
ConditionReturn Adaptive:DirectionReturn	27.07143	14	0.4744898
ConditionOut Adaptive:DirectionOut	29.92857	14	0.5255102
ConditionOut Adaptive:DirectionReturn	22.96429	14	0.4011480

Wald-Type Statistic (WTS):

	Statistic	df	p-value
Condition	0.7447525	1	0.38814272
Direction	3.8306553	1	0.05032325
Condition:Direction	0.0000000	1	NA

ANOVA-Type Statistic (ATS):

	Statistic	df	p-value
Condition	7.447525e-01	1	0.38814272
Direction	3.830655e+00	1	0.05032325
Condition:Direction	1.908079e-31	1	1.00000000

Modified ANOVA-Type Statistic for the Whole-Plot Factors:

	Statistic	df1	df2	p-value
Condition	0.7447525	1	24.90955	0.3963759

```

q5<-nparLD( Q5 ~ Direction * Condition, data=data, 'P' )
summary(q5)
plot(q5)
title(main="Q5                                     ",ylab="Relative
Effects")
Total number of observations:  56
Total number of subjects:    28
Total number of missing observations:  0

Class level information
-----
Levels of Direction (sub-plot factor time) :  2
Levels of Condition (whole-plot factor group) :  2

Abbreviations
-----
RankMeans = Rank means
Nobs = Number of observations
RTE = Relative treatment effect
case2x2 = tests for 2-by-2 design
Wald.test = Wald-type test statistic
ANOVA.test = ANOVA-type test statistic with Box approximation
ANOVA.test.mod.Box = modified ANOVA-type test statistic with Box
approximation
Wald.test.time = Wald-type test statistic for simple time effect
ANOVA.test.time = ANOVA-type test statistic for simple time effect
N = Standard Normal Distribution N(0,1)
T = Student's T distribution with respective degrees of freedom
pattern.time (time effects) = Test against patterned alternatives in time
using normal distribution ( no pattern specified )
pair.comparison = Tests for pairwise comparisons (without specifying a
pattern)
pattern.pair.comparison = Test for pairwise comparisons with patterned
alternatives in time ( no pattern specified )
pattern.group (group effects) = Test against patterned alternatives in
group ( no pattern specified )
covariance = Covariance matrix
Note: The description output above will disappear by setting
description=FALSE in the input. See the help file for details.

F1 LD F1 Model
-----
Check that the order of the time and group levels are correct.
Time level:   Out Return
Group level:  Return Adaptive Out Adaptive
If the order is not correct, specify the correct order in time.order or
group.order.

> summary(q5)
Model:
F1 LD F1 Model

Call:

```

Q5 ~ Direction \* Condition

Relative Treatment Effect (RTE):

	RankMeans	Nobs	RTE
ConditionReturn Adaptive	26.96429	28	0.4725765
ConditionOut Adaptive	30.03571	28	0.5274235
DirectionOut	26.66071	28	0.4671556
DirectionReturn	30.33929	28	0.5328444
ConditionReturn Adaptive:DirectionOut	29.92857	14	0.5255102
ConditionReturn Adaptive:DirectionReturn	24.00000	14	0.4196429
ConditionOut Adaptive:DirectionOut	23.39286	14	0.4088010
ConditionOut Adaptive:DirectionReturn	36.67857	14	0.6460459

Wald-Type Statistic (WTS):

	Statistic	df	p-value
Condition	0.335988	1	0.5621542421
Direction	2.498859	1	0.1139288466
Condition:Direction	17.044010	1	0.0000365234

ANOVA-Type Statistic (ATS):

	Statistic	df	p-value
Condition	0.335988	1	0.5621542421
Direction	2.498859	1	0.1139288466
Condition:Direction	17.044010	1	0.0000365234

Modified ANOVA-Type Statistic for the Whole-Plot Factors:

	Statistic	df1	df2	p-value
Condition	0.335988	1	24.56765	0.5674323

>

```

q6<-nparLD( Q6 ~ Direction * Condition, data=data, 'P' )
summary(q6)
plot(q6)
title(main="Q6", ylab="Relative
Effects")
Total number of observations: 56
Total number of subjects: 28
Total number of missing observations: 0

Class level information
-----
Levels of Direction (sub-plot factor time) : 2
Levels of Condition (whole-plot factor group) : 2

Abbreviations
-----
RankMeans = Rank means
Nobs = Number of observations
RTE = Relative treatment effect
case2x2 = tests for 2-by-2 design
Wald.test = Wald-type test statistic
ANOVA.test = ANOVA-type test statistic with Box approximation
ANOVA.test.mod.Box = modified ANOVA-type test statistic with Box
approximation
Wald.test.time = Wald-type test statistic for simple time effect
ANOVA.test.time = ANOVA-type test statistic for simple time effect
N = Standard Normal Distribution N(0,1)
T = Student's T distribution with respective degrees of freedom
pattern.time (time effects) = Test against patterned alternatives in time
using normal distribution ( no pattern specified )
pair.comparison = Tests for pairwise comparisons (without specifying a
pattern)
pattern.pair.comparison = Test for pairwise comparisons with patterned
alternatives in time ( no pattern specified )
pattern.group (group effects) = Test against patterned alternatives in
group ( no pattern specified )
covariance = Covariance matrix
Note: The description output above will disappear by setting
description=FALSE in the input. See the help file for details.

F1 LD F1 Model
-----
Check that the order of the time and group levels are correct.
Time level: Out Return
Group level: Return Adaptive Out Adaptive
If the order is not correct, specify the correct order in time.order or
group.order.

> summary(q6)
Model:
F1 LD F1 Model

Call:

```

Q6 ~ Direction \* Condition

Relative Treatment Effect (RTE):

	RankMeans	Nobs	RTE
ConditionReturn Adaptive	29.71429	28	0.5216837
ConditionOut Adaptive	27.28571	28	0.4783163
DirectionOut	29.85714	28	0.5242347
DirectionReturn	27.14286	28	0.4757653
ConditionReturn Adaptive:DirectionOut	24.67857	14	0.4317602
ConditionReturn Adaptive:DirectionReturn	34.75000	14	0.6116071
ConditionOut Adaptive:DirectionOut	35.03571	14	0.6167092
ConditionOut Adaptive:DirectionReturn	19.53571	14	0.3399235

Wald-Type Statistic (WTS):

	Statistic	df	p-value
Condition	0.2879396	1	0.5915439139
Direction	0.6552410	1	0.4182450867
Condition:Direction	14.5391811	1	0.0001372747

ANOVA-Type Statistic (ATS):

	Statistic	df	p-value
Condition	0.2879396	1	0.5915439139
Direction	0.6552410	1	0.4182450867
Condition:Direction	14.5391811	1	0.0001372747

Modified ANOVA-Type Statistic for the Whole-Plot Factors:

	Statistic	df1	df2	p-value
Condition	0.2879396	1	24.74018	0.5963368

