**“An investigation of the effect of acute pain on logical reasoning”**

**SPSS analysis code**

**\*Experiment 1**

**\*Experiment 1: Pain threshold and VAS ratings**

*\*Descriptive statistics for pain threshold:*

DESCRIPTIVES VARIABLES=Adjusted\_Pain\_Threshold

/STATISTICS=MEAN STDDEV MIN MAX.

*\*T-test comparing pain threshold between males and females:*

T-TEST GROUPS=Sex(1 2)

/MISSING=ANALYSIS

/VARIABLES=Adjusted\_Pain\_Threshold

/CRITERIA=CI(.95).

*\*Descriptive statistics for VAS scale ratings:*

DESCRIPTIVES VARIABLES=Pain\_Intensity\_VAS Worst\_Pain\_Intensity\_VAS Distraction\_VAS

/STATISTICS=MEAN STDDEV MIN MAX.

*\*T-tests comparing responses to the three VAS questions to zero:*

T-TEST

/TESTVAL=0

/MISSING=ANALYSIS

/VARIABLES=Pain\_Intensity\_VAS Worst\_Pain\_Intensity\_VAS Distraction\_VAS

/CRITERIA=CI(.95).

*\*T-tests comparing responses to the three VAS questions between males and females:*

T-TEST GROUPS=Sex(1 2)

/MISSING=ANALYSIS

/VARIABLES=Pain\_Intensity\_VAS Worst\_Pain\_Intensity\_VAS Distraction\_VAS

/CRITERIA=CI(.95).

**\*Experiment 1: The effect of pain on task performance: CRT**

*\*Mann-Whitney U tests comparing CRT3 & 7 scores between the pain and no pain conditions:*

NPTESTS

/INDEPENDENT TEST (CRT3\_corr CRT7\_corr) GROUP (CRT\_condition)

/MISSING SCOPE=ANALYSIS USERMISSING=EXCLUDE

/CRITERIA ALPHA=0.05 CILEVEL=95.

*\*Correlations between Pain Intensity Ratings and CRT3 & 7 scores in the pain group only:*

SORT CASES BY CRT\_condition.

SPLIT FILE LAYERED BY CRT\_condition.

NONPAR CORR

/VARIABLES=Pain\_Intensity\_VAS CRT3\_corr CRT7\_corr

/PRINT=SPEARMAN TWOTAIL NOSIG

/MISSING=PAIRWISE.

SPLIT FILE OFF.

**\*Experiment 1: The effect of pain on task performance: Belief Bias Syllogisms**

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*\*Pain × Believability × Validity × Sex ANOVA on syllogism endorsement rates:*

GLM Syllogisms\_believable\_invalid\_endorsed\_nopain Syllogisms\_believable\_valid\_endorsed\_nopain

Syllogisms\_neutral\_invalid\_endorsed\_nopain Syllogisms\_neutral\_valid\_endorsed\_nopain

Syllogisms\_unbelievable\_invalid\_endorsed\_nopain Syllogisms\_unbelievable\_valid\_endorsed\_nopain

Syllogisms\_believable\_invalid\_endorsed\_pain Syllogisms\_believable\_valid\_endorsed\_pain

Syllogisms\_neutral\_invalid\_endorsed\_pain Syllogisms\_neutral\_valid\_endorsed\_pain

Syllogisms\_unbelievable\_invalid\_endorsed\_pain Syllogisms\_unbelievable\_valid\_endorsed\_pain BY Sex

/WSFACTOR=Pain 2 Polynomial Believability 3 Polynomial Validity 2 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(OVERALL)

/EMMEANS=TABLES(Sex) COMPARE ADJ(LSD)

/EMMEANS=TABLES(Pain) COMPARE ADJ(LSD)

/EMMEANS=TABLES(Believability) COMPARE ADJ(LSD)

/EMMEANS=TABLES(Validity) COMPARE ADJ(LSD)

/EMMEANS=TABLES(Sex\*Pain)

/EMMEANS=TABLES(Sex\*Believability)

/EMMEANS=TABLES(Sex\*Validity)

/EMMEANS=TABLES(Pain\*Believability)

/EMMEANS=TABLES(Pain\*Validity)

/EMMEANS=TABLES(Believability\*Validity)

/EMMEANS=TABLES(Sex\*Pain\*Believability)

/EMMEANS=TABLES(Sex\*Pain\*Validity)

/EMMEANS=TABLES(Sex\*Believability\*Validity)

/EMMEANS=TABLES(Pain\*Believability\*Validity)

/EMMEANS=TABLES(Sex\*Pain\*Believability\*Validity)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=Pain Believability Validity Pain\*Believability Pain\*Validity Believability\*Validity

Pain\*Believability\*Validity

/DESIGN=Sex.

*\*One-way ANOVA comparing endorsement rates between Believability conditions within the valid items:*

GLM Syllogisms\_believable\_valid Syllogisms\_neutral\_valid Syllogisms\_unbelievable\_valid

/WSFACTOR=Believability 3 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(OVERALL)

/EMMEANS=TABLES(Believability) COMPARE ADJ(LSD)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=Believability.

*\*One-way ANOVA comparing endorsement rates between Believability conditions within the invalid items:*

GLM Syllogisms\_believable\_invalid Syllogisms\_neutral\_invalid Syllogisms\_unbelievable\_invalid

/WSFACTOR=Believability 3 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(OVERALL)

/EMMEANS=TABLES(Believability) COMPARE ADJ(LSD)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=Believability.

*\*T-tests comparing endorsement rates on each syllogism type to chance level:*

T-TEST

/TESTVAL=.5

/MISSING=ANALYSIS

/VARIABLES=Syllogisms\_believable\_valid Syllogisms\_believable\_invalid Syllogisms\_neutral\_valid

Syllogisms\_neutral\_invalid Syllogisms\_unbelievable\_valid Syllogisms\_unbelievable\_invalid

/CRITERIA=CI(.95).

*\*Correlations between total correct and belief bias index scores on the syllogisms task in the pain condition and pain intensity:*

CORRELATIONS

/VARIABLES=Syllogisms\_total\_correct\_pain Belief\_Bias\_pain Pain\_Intensity\_VAS

/PRINT=TWOTAIL NOSIG

/MISSING=PAIRWISE.

**\*Experiment 1: Conditional Inference Task**

*\*Pain × Inference × Sex ANOVA on Conditional Inference task endorsement rates:*

GLM CondInf\_MP\_end\_nopain CondInf\_DA\_end\_nopain CondInf\_AC\_end\_nopain CondInf\_MT\_end\_nopain

CondInf\_MP\_end\_pain CondInf\_DA\_end\_pain CondInf\_AC\_end\_pain CondInf\_MT\_end\_pain BY Sex

/WSFACTOR=Pain 2 Polynomial Inference 4 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(OVERALL)

/EMMEANS=TABLES(Sex) COMPARE ADJ(LSD)

/EMMEANS=TABLES(Pain) COMPARE ADJ(LSD)

/EMMEANS=TABLES(Inference) COMPARE ADJ(LSD)

/EMMEANS=TABLES(Sex\*Pain)

/EMMEANS=TABLES(Sex\*Inference)

/EMMEANS=TABLES(Pain\*Inference)

/EMMEANS=TABLES(Sex\*Pain\*Inference)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=Pain Inference Pain\*Inference

/DESIGN=Sex.

*\*Correlations between number of items endorsed for each inference type, and pain intensity:*

NONPAR CORR

/VARIABLES=Pain\_Intensity\_VAS CondInf\_MP\_end\_pain CondInf\_DA\_end\_pain CondInf\_AC\_end\_pain

CondInf\_MT\_end\_pain

/PRINT=SPEARMAN TWOTAIL NOSIG

/MISSING=PAIRWISE.

*\****Experiment 2**

*\****Experiment 2: VAS ratings**

*\*Descriptive statistics for VAS ratings of pain, worst pain, and intrusiveness:*

DESCRIPTIVES VARIABLES=Pain\_VAS Worst\_pain\_VAS Distraction\_VAS

/STATISTICS=MEAN STDDEV MIN MAX.

*\*T-tests comparing responses to the three VAS questions in the low and high pain conditions to zero:*

T-TEST

/TESTVAL=0

/MISSING=ANALYSIS

/VARIABLES=Pain\_VAS Worst\_pain\_VAS Distraction\_VAS

/CRITERIA=CI(.95).

*\*T-tests comparing responses to the three VAS in males vs females:*

T-TEST GROUPS=Sex(1 2)

/MISSING=ANALYSIS

/VARIABLES=Pain\_VAS Worst\_pain\_VAS Distraction\_VAS

/CRITERIA=CI(.95).

*\****Experiment 2: The effect of pain on task performance: CRT**

*\*Mann-Whitney U test comparing CRT3 & 7 scores between the pain conditions:*

NPTESTS

/INDEPENDENT TEST (CRT7\_correct CRT3\_correct) GROUP (CRT\_pain\_condition)

/MISSING SCOPE=ANALYSIS USERMISSING=EXCLUDE

/CRITERIA ALPHA=0.05 CILEVEL=95.

*\*Correlations between Pain Intensity and CRT3 & 7 scores in the pain group only:*

SORT CASES BY CRT\_pain\_condition.

SPLIT FILE LAYERED BY CRT\_pain\_condition.

NONPAR CORR

/VARIABLES=Pain\_VAS CRT7\_correct CRT3\_correct

/PRINT=SPEARMAN TWOTAIL NOSIG

/MISSING=PAIRWISE.

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*\****Experiment 2: The effect of pain on task performance: syllogisms**

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*\*Pain x Believability x Validity x Sex ANOVA on syllogisms endorsement rates:*

GLM Syllogisms\_believable\_invalid\_endorsed\_nopain Syllogisms\_believable\_valid\_endorsed\_nopain

Syllogisms\_neutral\_invalid\_endorsed\_nopain Syllogisms\_neutral\_valid\_endorsed\_nopain

Syllogisms\_unbelievable\_invalid\_endorsed\_nopain Syllogisms\_unbelievable\_valid\_endorsed\_nopain

Syllogisms\_believable\_invalid\_endorsed\_pain Syllogisms\_believable\_valid\_endorsed\_pain

Syllogisms\_neutral\_invalid\_endorsed\_pain Syllogisms\_neutral\_valid\_endorsed\_pain

Syllogisms\_unbelievable\_invalid\_endorsed\_pain Syllogisms\_unbelievable\_valid\_endorsed\_pain BY Sex

/WSFACTOR=pain 2 Polynomial believability 3 Polynomial validity 2 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(OVERALL)

/EMMEANS=TABLES(Sex) COMPARE ADJ(LSD)

/EMMEANS=TABLES(pain) COMPARE ADJ(LSD)

/EMMEANS=TABLES(believability) COMPARE ADJ(LSD)

/EMMEANS=TABLES(validity) COMPARE ADJ(LSD)

/EMMEANS=TABLES(Sex\*pain)

/EMMEANS=TABLES(Sex\*believability)

/EMMEANS=TABLES(Sex\*validity)

/EMMEANS=TABLES(pain\*believability)

/EMMEANS=TABLES(pain\*validity)

/EMMEANS=TABLES(believability\*validity)

/EMMEANS=TABLES(Sex\*pain\*believability)

/EMMEANS=TABLES(Sex\*pain\*validity)

/EMMEANS=TABLES(Sex\*believability\*validity)

/EMMEANS=TABLES(pain\*believability\*validity)

/EMMEANS=TABLES(Sex\*pain\*believability\*validity)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=pain believability validity pain\*believability pain\*validity believability\*validity

pain\*believability\*validity

/DESIGN=Sex.

*\*One-way ANOVA on believability within the valid items:*

GLM Syllogisms\_valid\_believable\_end Syllogisms\_valid\_neutral\_end Syllogisms\_valid\_unbelievable\_end

/WSFACTOR=believability 3 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(OVERALL)

/EMMEANS=TABLES(believability) COMPARE ADJ(LSD)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=believability.

*\*One-way ANOVA on believability within the invalid items:*

GLM Syllogisms\_invalid\_believable\_end Syllogisms\_invalid\_neutral\_end

Syllogisms\_invalid\_unbelievable\_end

/WSFACTOR=believability 3 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(OVERALL)

/EMMEANS=TABLES(believability) COMPARE ADJ(LSD)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=believability.

*\*Comparison of endorsement rates to chance level for each item type, across pain condition:*

T-TEST

/TESTVAL=.5

/MISSING=ANALYSIS

/VARIABLES=Syllogisms\_valid\_believable\_end Syllogisms\_valid\_neutral\_end

Syllogisms\_valid\_unbelievable\_end Syllogisms\_invalid\_believable\_end Syllogisms\_invalid\_neutral\_end

Syllogisms\_invalid\_unbelievable\_end

/CRITERIA=CI(.95).

*\*Number of valid and invalid items endorsed in males vs females:*

T-TEST GROUPS=Sex(1 2)

/MISSING=ANALYSIS

/VARIABLES=Syllogisms\_valid\_end Syllogisms\_invalid\_end

/CRITERIA=CI(.95).

*\*Pain x Validity in the believable items:*

GLM Syllogisms\_believable\_invalid\_endorsed\_nopain Syllogisms\_believable\_valid\_endorsed\_nopain

Syllogisms\_believable\_invalid\_endorsed\_pain Syllogisms\_believable\_valid\_endorsed\_pain

/WSFACTOR=pain 2 Polynomial validity 2 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(OVERALL)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=pain validity pain\*validity.

*\*Pain x Validity in the neutral items:*

GLM Syllogisms\_neutral\_invalid\_endorsed\_nopain Syllogisms\_neutral\_valid\_endorsed\_nopain

Syllogisms\_neutral\_invalid\_endorsed\_pain Syllogisms\_neutral\_valid\_endorsed\_pain

/WSFACTOR=pain 2 Polynomial validity 2 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(OVERALL)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=pain validity pain\*validity.

*\*Pain x Validity in the unbelievable items:*

GLM Syllogisms\_unbelievable\_invalid\_endorsed\_nopain Syllogisms\_unbelievable\_valid\_endorsed\_nopain

Syllogisms\_unbelievable\_invalid\_endorsed\_pain Syllogisms\_unbelievable\_valid\_endorsed\_pain

/WSFACTOR=pain 2 Polynomial validity 2 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(OVERALL)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=pain validity pain\*validity.

*\*Endorsement rates for valid and invalid items in the pain vs no pain conditions:*

T-TEST PAIRS=Syllogisms\_believable\_invalid\_endorsed\_nopain

Syllogisms\_believable\_valid\_endorsed\_nopain WITH Syllogisms\_believable\_invalid\_endorsed\_pain

Syllogisms\_believable\_valid\_endorsed\_pain (PAIRED)

/CRITERIA=CI(.9500)

/MISSING=ANALYSIS.

*\****Experiment 3**

*\****Experiment 3: VAS ratings**

*\*Descriptive statistics for VAS ratings of pain, worst pain, and intrusiveness:*

DESCRIPTIVES VARIABLES=Average\_Pain\_VAS\_Low\_Pain\_Condition Average\_Pain\_VAS\_High\_Pain\_Condition

Highest\_Pain\_VAS\_Low\_Pain\_Condition Highest\_Pain\_VAS\_High\_Pain\_Condition

Distraction\_VAS\_Low\_Pain\_Condition Distraction\_VAS\_High\_Pain\_Condition

/STATISTICS=MEAN STDDEV MIN MAX.

*\*T-tests comparing responses to the three VAS questions between the low and high pain conditions:*

T-TEST PAIRS=Average\_Pain\_VAS\_Low\_Pain\_Condition Highest\_Pain\_VAS\_Low\_Pain\_Condition

Distraction\_VAS\_Low\_Pain\_Condition WITH Average\_Pain\_VAS\_High\_Pain\_Condition

Highest\_Pain\_VAS\_High\_Pain\_Condition Distraction\_VAS\_High\_Pain\_Condition (PAIRED)

/CRITERIA=CI(.9500)

/MISSING=ANALYSIS.

*\*T-tests comparing responses to the three VAS questions in the low and high pain conditions to zero:*

T-TEST

/TESTVAL=0

/MISSING=ANALYSIS

/VARIABLES=Average\_Pain\_VAS\_Low\_Pain\_Condition Average\_Pain\_VAS\_High\_Pain\_Condition

Highest\_Pain\_VAS\_Low\_Pain\_Condition Highest\_Pain\_VAS\_High\_Pain\_Condition

Distraction\_VAS\_Low\_Pain\_Condition Distraction\_VAS\_High\_Pain\_Condition

/CRITERIA=CI(.95).

*\****Experiment 3: The effect of pain on task performance: CRT**

*\*Friedman’s test comparing CRT scores across the three pain conditions:*

NPAR TESTS

/FRIEDMAN=CRT\_corr\_nopain CRT\_corr\_lowpain CRT\_corr\_highpain

/MISSING LISTWISE.

*\****Experiment 3: The effect of pain on task performance: Raven’s Matrices**

*\*One-way ANOVA comparing Raven’s Matrix scores across the three pain conditions:*

GLM RAPM\_nopain RAPM\_lowpain RAPM\_highpain

/WSFACTOR=PainCondition 3 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(PainCondition) COMPARE ADJ(LSD)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=PainCondition.

*\****Experiment 3: The effect of pain on task performance: Syllogisms (endorsement rates)**

*\*Pain x Believability x Validity ANOVA comparing on syllogisms endorsement rates:*

GLM Syllogisms\_believable\_invalid\_endorsed\_nopain Syllogisms\_believable\_valid\_endorsed\_nopain

Syllogisms\_unbelievable\_invalid\_endorsed\_nopain Syllogisms\_unbelievable\_valid\_endorsed\_nopain

Syllogisms\_believable\_invalid\_endorsed\_lowpain Syllogisms\_believable\_valid\_endorsed\_lowpain

Syllogisms\_unbelievable\_invalid\_endorsed\_lowpain Syllogisms\_unbelievable\_valid\_endorsed\_lowpain

Syllogisms\_believable\_invalid\_endorsed\_highpain Syllogisms\_believable\_valid\_endorsed\_highpain

Syllogisms\_unbelievable\_invalid\_endorsed\_highpain Syllogisms\_unbelievable\_valid\_endorsed\_highpain

/WSFACTOR=PainCondition 3 Polynomial Believability 2 Polynomial Validity 2 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(PainCondition) COMPARE ADJ(LSD)

/EMMEANS=TABLES(OVERALL)

/EMMEANS=TABLES(Believability) COMPARE ADJ(LSD)

/EMMEANS=TABLES(Validity) COMPARE ADJ(LSD)

/EMMEANS=TABLES(PainCondition\*Believability)

/EMMEANS=TABLES(PainCondition\*Validity)

/EMMEANS=TABLES(Believability\*Validity)

/EMMEANS=TABLES(PainCondition\*Believability\*Validity)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=PainCondition Believability Validity PainCondition\*Believability PainCondition\*Validity

Believability\*Validity PainCondition\*Believability\*Validity.

*\****Experiment 3: The effect of pain on task performance: Syllogisms (confidence ratings)**

*\*Pain x Believability x Validity ANOVA comparing on syllogisms confidence ratings:*

GLM Syllogisms\_believable\_invalid\_confidence\_nopain Syllogisms\_believable\_valid\_confidence\_nopain

Syllogisms\_unbelievable\_invalid\_confidence\_nopain Syllogisms\_unbelievable\_valid\_confidence\_nopain

Syllogisms\_believable\_invalid\_confidence\_lowpain Syllogisms\_believable\_valid\_confidence\_lowpain

Syllogisms\_unbelievable\_invalid\_confidence\_lowpain Syllogisms\_unbelievable\_valid\_confidence\_lowpain

Syllogisms\_believable\_invalid\_confidence\_highpain Syllogisms\_believable\_valid\_confidence\_highpain

Syllogisms\_unbelievable\_invalid\_confidence\_highpain

Syllogisms\_unbelievable\_valid\_confidence\_highpain

/WSFACTOR=PainCondition 3 Polynomial Believability 2 Polynomial Validity 2 Polynomial

/METHOD=SSTYPE(3)

/EMMEANS=TABLES(OVERALL)

/EMMEANS=TABLES(PainCondition) COMPARE ADJ(LSD)

/EMMEANS=TABLES(Believability) COMPARE ADJ(LSD)

/EMMEANS=TABLES(Validity) COMPARE ADJ(LSD)

/EMMEANS=TABLES(PainCondition\*Believability)

/EMMEANS=TABLES(PainCondition\*Validity)

/EMMEANS=TABLES(Believability\*Validity)

/EMMEANS=TABLES(PainCondition\*Believability\*Validity)

/PRINT=DESCRIPTIVE ETASQ

/CRITERIA=ALPHA(.05)

/WSDESIGN=PainCondition Believability Validity PainCondition\*Believability PainCondition\*Validity

Believability\*Validity PainCondition\*Believability\*Validity.