# Experiment 2\_Quad

## RT Correct

## 

> df1.aov <- aov(RTCorrect ~ xpos1 \* ypos1\*predictability\*difficulty\*perfGrp + Error(code), data = df1)

> summary(df1.aov)

Error: code

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

**xpos1 6 89.67 14.94 60.967 < 2e-16 \*\*\***

**ypos1 3 8.92 2.97 12.135 1.09e-07 \*\*\***

predictability 1 0.01 0.01 0.025 0.8751

**difficulty 1 68.48 68.48 279.355 < 2e-16 \*\*\***

perfGrp 1 0.71 0.71 2.880 0.0903 .

xpos1:ypos1 3 1.04 0.35 1.419 0.2362

xpos1:predictability 6 0.27 0.05 0.186 0.9806

ypos1:predictability 3 0.79 0.26 1.072 0.3604

predictability:difficulty 1 0.30 0.30 1.243 0.2655

xpos1:perfGrp 6 0.68 0.11 0.460 0.8382

ypos1:perfGrp 3 0.36 0.12 0.493 0.6874

predictability:perfGrp 1 0.01 0.01 0.032 0.8590

difficulty:perfGrp 1 0.59 0.59 2.418 0.1205

xpos1:ypos1:predictability 3 0.21 0.07 0.279 0.8407

xpos1:ypos1:perfGrp 3 0.57 0.19 0.776 0.5078

xpos1:predictability:perfGrp 6 2.19 0.36 1.488 0.1802

ypos1:predictability:perfGrp 3 0.51 0.17 0.690 0.5587

predictability:difficulty:perfGrp 1 0.16 0.16 0.651 0.4202

xpos1:ypos1:predictability:perfGrp 3 0.57 0.19 0.770 0.5113

Residuals 520 127.46 0.25

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

Error: Within

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

**perfGrp 1 1.5 1.4580 6.214 0.0127 \***

**xpos1:perfGrp 6 12.2 2.0386 8.688 1.99e-09 \*\*\***

ypos1:perfGrp 3 0.8 0.2614 1.114 0.3420

predictability:perfGrp 1 0.1 0.0614 0.262 0.6091

difficulty:perfGrp 1 0.0 0.0097 0.041 0.8387

xpos1:ypos1:perfGrp 3 0.4 0.1325 0.565 0.6383

xpos1:predictability:perfGrp 6 0.4 0.0593 0.253 0.9584

ypos1:predictability:perfGrp 3 0.3 0.1069 0.456 0.7133

predictability:difficulty:perfGrp 1 0.1 0.1461 0.622 0.4302

xpos1:ypos1:predictability:perfGrp 3 0.1 0.0491 0.209 0.8901

Residuals 4613 1082.4 0.2346

---

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

> aov\_df1 <- aov(RTCorrect~ xpos1 + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ xpos1)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**(-0.383) - (-0.707) 0.18499 0.0458 569 4.041 0.0012**

(-0.383) - (-0.924) -0.02085 0.0557 569 -0.374 0.9998

(-0.383) - NaN -0.11826 0.0418 569 -2.830 0.0714

(-0.383) - 0.383 -0.02305 0.0553 569 -0.417 0.9996

**(-0.383) - 0.707 0.18660 0.0459 569 4.066 0.0011**

(-0.383) - 0.924 -0.00473 0.0543 569 -0.087 1.0000

**(-0.707) - (-0.924) -0.20585 0.0446 569 -4.618 0.0001**

**(-0.707) - NaN -0.30325 0.0251 569 -12.077 <.0001**

**(-0.707) - 0.383 -0.20804 0.0441 569 -4.722 0.0001**

(-0.707) - 0.707 0.00160 0.0315 569 0.051 1.0000

**(-0.707) - 0.924 -0.18973 0.0428 569 -4.433 0.0002**

(-0.924) - NaN -0.09740 0.0405 569 -2.407 0.1975

(-0.924) - 0.383 -0.00219 0.0543 569 -0.040 1.0000

**(-0.924) - 0.707 0.20745 0.0447 569 4.642 0.0001**

(-0.924) - 0.924 0.01612 0.0533 569 0.303 0.9999

NaN - 0.383 0.09521 0.0399 569 2.387 0.2061

**NaN - 0.707 0.30486 0.0253 569 12.048 <.0001**

NaN - 0.924 0.11353 0.0385 569 2.948 0.0515

**0.383 - 0.707 0.20964 0.0442 569 4.747 0.0001**

0.383 - 0.924 0.01831 0.0528 569 0.347 0.9999

**0.707 - 0.924 -0.19133 0.0429 569 -4.458 0.0002**

P value adjustment: tukey method for comparing a family of 7 estimates

> aov\_df1 <- aov(RTCorrect~ ypos1 + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ ypos1)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**(-0.383) - (-0.707) 0.2644 0.0451 569 5.860 <.0001**

(-0.383) - (-0.924) -0.0643 0.0594 569 -1.082 0.9332

(-0.383) - NaN -0.0259 0.0411 569 -0.631 0.9958

(-0.383) - 0.383 0.1420 0.0525 569 2.705 0.0989

**(-0.383) - 0.707 0.2914 0.0449 569 6.485 <.0001**

**(-0.383) - 0.924 0.1648 0.0521 569 3.165 0.0271**

**(-0.707) - (-0.924) -0.3287 0.0496 569 -6.625 <.0001**

**(-0.707) - NaN -0.2903 0.0248 569 -11.687 <.0001**

**(-0.707) - 0.383 -0.1223 0.0411 569 -2.978 0.0473**

(-0.707) - 0.707 0.0271 0.0308 569 0.879 0.9756

(-0.707) - 0.924 -0.0996 0.0405 569 -2.458 0.1770

(-0.924) - NaN 0.0384 0.0460 569 0.835 0.9812

**(-0.924) - 0.383 0.2064 0.0564 569 3.657 0.0052**

**(-0.924) - 0.707 0.3558 0.0495 569 7.193 <.0001**

**(-0.924) - 0.924 0.2291 0.0560 569 4.091 0.0010**

**NaN - 0.383 0.1680 0.0366 569 4.589 0.0001**

**NaN - 0.707 0.3174 0.0245 569 12.941 <.0001**

**NaN - 0.924 0.1907 0.0360 569 5.304 <.0001**

**0.383 - 0.707 0.1494 0.0409 569 3.654 0.0052**

0.383 - 0.924 0.0228 0.0486 569 0.469 0.9992

**0.707 - 0.924 -0.1266 0.0403 569 -3.141 0.0292**

P value adjustment: tukey method for comparing a family of 7 estimates

> aov\_df1 <- aov(RTCorrect~ predictability + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ predictability)

> pairs(emm)

contrast estimate SE df t.ratio p.value

1 - 3 0.00311 0.0214 574 0.145 0.8845

> aov\_df1 <- aov(RTCorrect~ difficulty + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ difficulty)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**4 - 8 -0.269 0.0171 574 -15.742 <.0001**

> aov\_df1 <- aov(RTCorrect~ perfGrp + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ perfGrp)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**1 - 2 -0.0339 0.0137 4640 -2.483 0.0130**

## Score

> df1.aov <- aov(score ~ xpos1 \* ypos1\*predictability\*difficulty\*perfGrp + Error(code), data = df1)

> summary(df1.aov)

Error: code

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

**xpos1 6 82.96 13.83 108.997 <2e-16 \*\*\***

**ypos1 3 27.07 9.02 71.145 <2e-16 \*\*\***

predictability 1 0.18 0.18 1.433 0.2317

**difficulty 1 45.58 45.58 359.331 <2e-16 \*\*\***

xpos1:ypos1 3 0.13 0.04 0.340 0.7964

**xpos1:predictability 6 2.09 0.35 2.745 0.0123 \***

ypos1:predictability 3 0.21 0.07 0.547 0.6500

predictability:difficulty 1 0.00 0.00 0.020 0.8878

**xpos1:ypos1:predictability 3 1.27 0.42 3.348 0.0189 \***

Residuals 548 69.51 0.13

---

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

Error: Within

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

**perfGrp 1 1.8 1.831 15.583 7.99e-05 \*\*\***

**xpos1:perfGrp 6 5.8 0.961 8.173 8.00e-09 \*\*\***

**ypos1:perfGrp 3 2.1 0.714 6.074 0.000401 \*\*\***

predictability:perfGrp 1 0.0 0.003 0.027 0.868488

**difficulty:perfGrp 1 5.7 5.669 48.236 4.20e-12 \*\*\***

xpos1:ypos1:perfGrp 3 0.1 0.032 0.276 0.842974

**xpos1:predictability:perfGrp 6 2.2 0.361 3.069 0.005321 \*\***

ypos1:predictability:perfGrp 3 0.3 0.111 0.946 0.417464

predictability:difficulty:perfGrp 1 0.0 0.005 0.043 0.835695

xpos1:ypos1:predictability:perfGrp 3 0.7 0.240 2.044 0.105517

Residuals 5732 673.6 0.118

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

> aov\_df1 <- aov(score~ xpos1 + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ xpos1)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**(-0.383) - (-0.707) -0.3775 0.0312 569 -12.107 <.0001**

(-0.383) - (-0.924) -0.0429 0.0360 569 -1.192 0.8970

**(-0.383) - NaN -0.2532 0.0270 569 -9.375 <.0001**

(-0.383) - 0.383 -0.0631 0.0360 569 -1.753 0.5802

**(-0.383) - 0.707 -0.3586 0.0312 569 -11.500 <.0001**

**(-0.383) - 0.924 -0.1162 0.0360 569 -3.226 0.0224**

**(-0.707) - (-0.924) 0.3346 0.0312 569 10.731 <.0001**

**(-0.707) - NaN 0.1244 0.0201 569 6.179 <.0001**

**(-0.707) - 0.383 0.3144 0.0312 569 10.083 <.0001**

(-0.707) - 0.707 0.0189 0.0255 569 0.744 0.9897

**(-0.707) - 0.924 0.2614 0.0312 569 8.382 <.0001**

**(-0.924) - NaN -0.2102 0.0270 569 -7.785 <.0001**

(-0.924) - 0.383 -0.0202 0.0360 569 -0.561 0.9978

**(-0.924) - 0.707 -0.3157 0.0312 569 -10.123 <.0001**

(-0.924) - 0.924 -0.0732 0.0360 569 -2.034 0.3943

**NaN - 0.383 0.1900 0.0270 569 7.037 <.0001**

**NaN - 0.707 -0.1054 0.0201 569 -5.238 <.0001**

**NaN - 0.924 0.1370 0.0270 569 5.073 <.0001**

**0.383 - 0.707 -0.2955 0.0312 569 -9.475 <.0001**

0.383 - 0.924 -0.0530 0.0360 569 -1.473 0.7609

**0.707 - 0.924 0.2424 0.0312 569 7.775 <.0001**

P value adjustment: tukey method for comparing a family of 7 estimates

> aov\_df1 <- aov(score~ ypos1 + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ ypos1)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**(-0.383) - (-0.707) -0.3573 0.0284 569 -12.591 <.0001**

**(-0.383) - (-0.924) 0.1263 0.0328 569 3.853 0.0025**

**(-0.383) - NaN -0.2582 0.0246 569 -10.506 <.0001**

**(-0.383) - 0.383 -0.1692 0.0328 569 -5.163 <.0001**

**(-0.383) - 0.707 -0.3889 0.0284 569 -13.704 <.0001**

**(-0.383) - 0.924 -0.1995 0.0328 569 -6.088 <.0001**

**(-0.707) - (-0.924) 0.4836 0.0284 569 17.041 <.0001**

**(-0.707) - NaN 0.0991 0.0183 569 5.411 <.0001**

**(-0.707) - 0.383 0.1881 0.0284 569 6.629 <.0001**

(-0.707) - 0.707 -0.0316 0.0232 569 -1.362 0.8216

**(-0.707) - 0.924 0.1578 0.0284 569 5.562 <.0001**

**(-0.924) - NaN -0.3845 0.0246 569 -15.644 <.0001**

**(-0.924) - 0.383 -0.2955 0.0328 569 -9.016 <.0001**

**(-0.924) - 0.707 -0.5152 0.0284 569 -18.153 <.0001**

**(-0.924) - 0.924 -0.3258 0.0328 569 -9.941 <.0001**

**NaN - 0.383 0.0890 0.0246 569 3.622 0.0059**

**NaN - 0.707 -0.1307 0.0183 569 -7.134 <.0001**

NaN - 0.924 0.0587 0.0246 569 2.389 0.2051

**0.383 - 0.707 -0.2197 0.0284 569 -7.742 <.0001**

0.383 - 0.924 -0.0303 0.0328 569 -0.925 0.9685

**0.707 - 0.924 0.1894 0.0284 569 6.674 <.0001**

P value adjustment: tukey method for comparing a family of 7 estimates

> aov\_df1 <- aov(score~ predictability + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ predictability)

> pairs(emm)

contrast estimate SE df t.ratio p.value

1 - 3 0.0114 0.0168 574 0.675 0.4997

> aov\_df1 <- aov(score~ difficulty + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ difficulty)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**4 - 8 0.276 0.0109 574 25.322 <.0001**

> aov\_df1 <- aov(score~ perfGrp + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ perfGrp)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**1 - 2 0.0341 0.00874 5759 3.908 0.0001**

## IES?

## Confidence

> df1.aov <- aov(confidence ~ xpos1 \* ypos1\*predictability\*difficulty\*perfGrp + Error(code), data = df1)

> summary(df1.aov)

Error: code

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

**xpos1 6 664.9 110.8 257.487 < 2e-16 \*\*\***

**ypos1 3 87.3 29.1 67.586 < 2e-16 \*\*\***

predictability 1 0.1 0.1 0.329 0.56635

**difficulty 1 1104.1 1104.1 2565.476 < 2e-16 \*\*\***

perfGrp 1 0.5 0.5 1.106 0.29345

xpos1:ypos1 3 3.0 1.0 2.354 0.07115 .

xpos1:predictability 6 3.5 0.6 1.374 0.22293

ypos1:predictability 3 1.9 0.6 1.486 0.21732

predictability:difficulty 1 0.3 0.3 0.740 0.39002

xpos1:perfGrp 4 2.9 0.7 1.700 0.14851

ypos1:perfGrp 1 0.1 0.1 0.130 0.71819

predictability:perfGrp 1 0.0 0.0 0.002 0.96806

**xpos1:ypos1:predictability 3 5.2 1.7 4.018 0.00762 \*\***

Residuals 541 232.8 0.4

---

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

Error: Within

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

**perfGrp 1 41.7 41.66 80.036 < 2e-16 \*\*\***

**xpos1:perfGrp 6 17.1 2.84 5.464 1.2e-05 \*\*\***

ypos1:perfGrp 3 3.9 1.31 2.519 0.05620 .

predictability:perfGrp 1 0.0 0.04 0.075 0.78439

**difficulty:perfGrp 1 5.3 5.26 10.115 0.00148 \*\***

xpos1:ypos1:perfGrp 3 3.3 1.11 2.132 0.09393 .

xpos1:predictability:perfGrp 6 3.2 0.53 1.023 0.40775

ypos1:predictability:perfGrp 3 0.8 0.26 0.495 0.68591

predictability:difficulty:perfGrp 1 0.1 0.15 0.284 0.59425

xpos1:ypos1:predictability:perfGrp 3 1.2 0.39 0.758 0.51741

Residuals 5721 2977.6 0.52

---

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

> aov\_df1 <- aov(confidence~ xpos1 + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ xpos1)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**(-0.383) - (-0.707) -0.87079 0.0981 569 -8.875 <.0001**

(-0.383) - (-0.924) -0.05823 0.1133 569 -0.514 0.9987

(-0.383) - NaN -0.14190 0.0849 569 -1.670 0.6361

(-0.383) - 0.383 -0.16148 0.1132 569 -1.426 0.7874

**(-0.383) - 0.707 -0.86466 0.0981 569 -8.816 <.0001**

(-0.383) - 0.924 -0.13370 0.1132 569 -1.181 0.9012

**(-0.707) - (-0.924) 0.81257 0.0981 569 8.282 <.0001**

**(-0.707) - NaN 0.72889 0.0633 569 11.506 <.0001**

**(-0.707) - 0.383 0.70932 0.0980 569 7.235 <.0001**

(-0.707) - 0.707 0.00614 0.0801 569 0.077 1.0000

**(-0.707) - 0.924 0.73710 0.0980 569 7.519 <.0001**

(-0.924) - NaN -0.08367 0.0849 569 -0.985 0.9572

(-0.924) - 0.383 -0.10325 0.1132 569 -0.912 0.9706

**(-0.924) - 0.707 -0.80643 0.0981 569 -8.223 <.0001**

(-0.924) - 0.924 -0.07547 0.1132 569 -0.667 0.9943

NaN - 0.383 -0.01957 0.0849 569 -0.231 1.0000

**NaN - 0.707 -0.72276 0.0633 569 -11.421 <.0001**

NaN - 0.924 0.00820 0.0849 569 0.097 1.0000

**0.383 - 0.707 -0.70318 0.0980 569 -7.176 <.0001**

0.383 - 0.924 0.02778 0.1131 569 0.246 1.0000

**0.707 - 0.924 0.73096 0.0980 569 7.459 <.0001**

P value adjustment: tukey method for comparing a family of 7 estimates

> aov\_df1 <- aov(confidence~ ypos1 + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ ypos1)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**(-0.383) - (-0.707) -0.8381 0.0953 569 -8.796 <.0001**

(-0.383) - (-0.924) 0.2451 0.1100 569 2.229 0.2817

(-0.383) - NaN -0.1343 0.0825 569 -1.627 0.6646

(-0.383) - 0.383 -0.1766 0.1100 569 -1.606 0.6786

**(-0.383) - 0.707 -0.8822 0.0953 569 -9.255 <.0001**

**(-0.383) - 0.924 -0.3924 0.1100 569 -3.566 0.0072**

**(-0.707) - (-0.924) 1.0832 0.0952 569 11.378 <.0001**

**(-0.707) - NaN 0.7038 0.0615 569 11.448 <.0001**

**(-0.707) - 0.383 0.6615 0.0952 569 6.948 <.0001**

(-0.707) - 0.707 -0.0441 0.0778 569 -0.567 0.9977

**(-0.707) - 0.924 0.4457 0.0953 569 4.678 0.0001**

**(-0.924) - NaN -0.3794 0.0824 569 -4.603 0.0001**

**(-0.924) - 0.383 -0.4217 0.1099 569 -3.837 0.0026**

**(-0.924) - 0.707 -1.1273 0.0952 569 -11.837 <.0001**

**(-0.924) - 0.924 -0.6375 0.1100 569 -5.797 <.0001**

NaN - 0.383 -0.0423 0.0824 569 -0.513 0.9987

**NaN - 0.707 -0.7479 0.0615 569 -12.153 <.0001**

**NaN - 0.924 -0.2581 0.0825 569 -3.127 0.0304**

**0.383 - 0.707 -0.7056 0.0952 569 -7.409 <.0001**

0.383 - 0.924 -0.2158 0.1100 569 -1.962 0.4401

**0.707 - 0.924 0.4898 0.0953 569 5.139 <.0001**

P value adjustment: tukey method for comparing a family of 7 estimates

> aov\_df1 <- aov(confidence~ predictability + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ predictability)

> pairs(emm)

contrast estimate SE df t.ratio p.value

1 - 3 0.0101 0.0511 574 0.197 0.8435

> aov\_df1 <- aov(confidence~ difficulty + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ difficulty)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**4 - 8 0.98 0.0254 574 38.549 <.0001**

> aov\_df1 <- aov(confidence~ perfGrp + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ perfGrp)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**1 - 2 0.163 0.0183 5748 8.915 <.0001**

# Experiment 1\_4Diff

## RT Correct

> df1.aov <- aov(RTCorrect ~ xpos1 \* ypos1\*predictability\*difficulty\*perfGrp + Error(code), data = df1)

> summary(df1.aov)

Error: code

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

xpos1 13 38.31 2.9470 11.132 <2e-16 \*\*\*

ypos1 7 3.59 0.5132 1.938 0.0668 .

predictability 1 0.10 0.0969 0.366 0.5460

difficulty 3 2.77 0.9237 3.489 0.0172 \*

perfGrp 1 1.69 1.6857 6.367 0.0126 \*

xpos1:ypos1 6 3.33 0.5558 2.100 0.0561 .

xpos1:predictability 13 5.06 0.3894 1.471 0.1336

ypos1:predictability 7 2.10 0.3003 1.134 0.3442

xpos1:difficulty 1 0.07 0.0708 0.267 0.6058

ypos1:difficulty 1 0.01 0.0133 0.050 0.8232

predictability:difficulty 3 0.47 0.1579 0.596 0.6183

xpos1:perfGrp 13 3.44 0.2644 0.999 0.4550

ypos1:perfGrp 7 1.77 0.2532 0.956 0.4652

predictability:perfGrp 1 0.01 0.0051 0.019 0.8897

difficulty:perfGrp 3 0.67 0.2246 0.848 0.4693

xpos1:ypos1:predictability 6 1.72 0.2859 1.080 0.3768

xpos1:predictability:difficulty 1 0.50 0.5019 1.896 0.1705

ypos1:predictability:difficulty 1 0.82 0.8219 3.105 0.0800 .

xpos1:ypos1:perfGrp 6 1.92 0.3201 1.209 0.3042

xpos1:predictability:perfGrp 13 3.06 0.2354 0.889 0.5658

ypos1:predictability:perfGrp 7 2.08 0.2966 1.120 0.3528

xpos1:difficulty:perfGrp 1 0.01 0.0077 0.029 0.8645

ypos1:difficulty:perfGrp 1 0.01 0.0070 0.026 0.8710

predictability:difficulty:perfGrp 3 0.85 0.2837 1.072 0.3628

xpos1:ypos1:predictability:perfGrp 6 1.90 0.3162 1.194 0.3120

xpos1:predictability:difficulty:perfGrp 1 0.09 0.0862 0.326 0.5690

ypos1:predictability:difficulty:perfGrp 1 0.09 0.0856 0.323 0.5703

Residuals 160 42.36 0.2647

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

Error: Within

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

xpos1 13 40.8 3.1386 10.509 < 2e-16 \*\*\*

ypos1 7 9.0 1.2922 4.327 8.96e-05 \*\*\*

perfGrp 1 1.7 1.6958 5.678 0.0173 \*

xpos1:ypos1 6 1.8 0.2979 0.998 0.4251

xpos1:predictability 13 4.3 0.3280 1.098 0.3552

ypos1:predictability 7 2.2 0.3097 1.037 0.4028

xpos1:difficulty 1 0.5 0.4895 1.639 0.2006

ypos1:difficulty 1 0.6 0.6329 2.119 0.1456

xpos1:perfGrp 13 5.9 0.4505 1.508 0.1063

ypos1:perfGrp 7 4.9 0.6954 2.329 0.0228 \*

predictability:perfGrp 1 0.0 0.0025 0.008 0.9277

difficulty:perfGrp 3 1.8 0.6114 2.047 0.1052

xpos1:ypos1:predictability 6 4.0 0.6681 2.237 0.0371 \*

xpos1:predictability:difficulty 1 0.1 0.1322 0.443 0.5059

ypos1:predictability:difficulty 1 0.8 0.8245 2.761 0.0967 .

xpos1:ypos1:perfGrp 6 1.0 0.1585 0.531 0.7852

xpos1:predictability:perfGrp 13 2.7 0.2100 0.703 0.7619

ypos1:predictability:perfGrp 7 1.9 0.2781 0.931 0.4808

xpos1:difficulty:perfGrp 1 0.0 0.0222 0.074 0.7854

ypos1:difficulty:perfGrp 1 0.2 0.1971 0.660 0.4166

predictability:difficulty:perfGrp 3 2.8 0.9198 3.080 0.0265 \*

xpos1:ypos1:predictability:perfGrp 6 1.1 0.1888 0.632 0.7046

xpos1:predictability:difficulty:perfGrp 1 0.7 0.6746 2.259 0.1330

ypos1:predictability:difficulty:perfGrp 1 0.0 0.0250 0.084 0.7722

Residuals 2520 752.6 0.2987

---

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

> aov\_df1 <- aov(RTCorrect~ xpos1 + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ xpos1)

> pairs(emm)

contrast estimate SE df t.ratio p.value

(-0.383) - (-0.588) -0.057570 0.1151 2627 -0.500 1.0000

(-0.383) - (-0.707) -0.003583 0.0870 2627 -0.041 1.0000

(-0.383) - (-0.866) -0.012455 0.0941 2627 -0.132 1.0000

(-0.383) - (-0.924) 0.073244 0.0977 2627 0.750 1.0000

(-0.383) - (-0.951) -0.067479 0.1165 2627 -0.579 1.0000

(-0.383) - NaN -0.278431 0.0735 2627 -3.787 0.0115

(-0.383) - 0.000 -0.094082 0.0894 2627 -1.052 0.9989

(-0.383) - 0.383 0.088128 0.0970 2627 0.908 0.9998

(-0.383) - 0.588 -0.085899 0.1110 2627 -0.774 1.0000

(-0.383) - 0.707 -0.058238 0.0876 2627 -0.665 1.0000

(-0.383) - 0.866 -0.132981 0.0985 2627 -1.350 0.9870

(-0.383) - 0.924 -0.003163 0.0941 2627 -0.034 1.0000

(-0.383) - 0.951 -0.151662 0.1091 2627 -1.390 0.9832

(-0.588) - (-0.707) 0.053987 0.1001 2627 0.539 1.0000

(-0.588) - (-0.866) 0.045115 0.1056 2627 0.427 1.0000

(-0.588) - (-0.924) 0.130814 0.1171 2627 1.117 0.9979

(-0.588) - (-0.951) -0.009910 0.1170 2627 -0.085 1.0000

(-0.588) - NaN -0.220861 0.0886 2627 -2.493 0.4128

(-0.588) - 0.000 -0.036513 0.0980 2627 -0.373 1.0000

(-0.588) - 0.383 0.145698 0.1179 2627 1.236 0.9943

(-0.588) - 0.588 -0.028330 0.1114 2627 -0.254 1.0000

(-0.588) - 0.707 -0.000669 0.1005 2627 -0.007 1.0000

(-0.588) - 0.866 -0.075411 0.1095 2627 -0.689 1.0000

(-0.588) - 0.924 0.054407 0.1135 2627 0.479 1.0000

(-0.588) - 0.951 -0.094093 0.1092 2627 -0.862 0.9999

(-0.707) - (-0.866) -0.008872 0.0749 2627 -0.118 1.0000

(-0.707) - (-0.924) 0.076827 0.0897 2627 0.857 0.9999

(-0.707) - (-0.951) -0.063896 0.1017 2627 -0.628 1.0000

(-0.707) - NaN -0.274848 0.0466 2627 -5.900 <.0001

(-0.707) - 0.000 -0.090499 0.0690 2627 -1.312 0.9899

(-0.707) - 0.383 0.091711 0.0907 2627 1.012 0.9992

(-0.707) - 0.588 -0.082316 0.0953 2627 -0.864 0.9999

(-0.707) - 0.707 -0.054655 0.0555 2627 -0.985 0.9994

(-0.707) - 0.866 -0.129398 0.0804 2627 -1.609 0.9441

(-0.707) - 0.924 0.000420 0.0850 2627 0.005 1.0000

(-0.707) - 0.951 -0.148080 0.0931 2627 -1.590 0.9490

(-0.866) - (-0.924) 0.085699 0.0965 2627 0.888 0.9998

(-0.866) - (-0.951) -0.055024 0.1072 2627 -0.513 1.0000

(-0.866) - NaN -0.265976 0.0587 2627 -4.532 0.0005

(-0.866) - 0.000 -0.081627 0.0715 2627 -1.142 0.9974

(-0.866) - 0.383 0.100583 0.0974 2627 1.032 0.9991

(-0.866) - 0.588 -0.073444 0.1011 2627 -0.727 1.0000

(-0.866) - 0.707 -0.045783 0.0755 2627 -0.606 1.0000

(-0.866) - 0.866 -0.120526 0.0789 2627 -1.528 0.9627

(-0.866) - 0.924 0.009292 0.0921 2627 0.101 1.0000

(-0.866) - 0.951 -0.139207 0.0990 2627 -1.407 0.9813

(-0.924) - (-0.951) -0.140724 0.1185 2627 -1.188 0.9961

(-0.924) - NaN -0.351675 0.0766 2627 -4.590 0.0004

(-0.924) - 0.000 -0.167327 0.0920 2627 -1.820 0.8674

(-0.924) - 0.383 0.014884 0.1014 2627 0.147 1.0000

(-0.924) - 0.588 -0.159144 0.1131 2627 -1.407 0.9812

(-0.924) - 0.707 -0.131483 0.0902 2627 -1.458 0.9746

(-0.924) - 0.866 -0.206225 0.1008 2627 -2.045 0.7388

(-0.924) - 0.924 -0.076407 0.0950 2627 -0.805 0.9999

(-0.924) - 0.951 -0.224907 0.1112 2627 -2.022 0.7541

(-0.951) - NaN -0.210952 0.0904 2627 -2.334 0.5296

(-0.951) - 0.000 -0.026603 0.1003 2627 -0.265 1.0000

(-0.951) - 0.383 0.155607 0.1192 2627 1.305 0.9905

(-0.951) - 0.588 -0.018420 0.1145 2627 -0.161 1.0000

(-0.951) - 0.707 0.009241 0.1021 2627 0.090 1.0000

(-0.951) - 0.866 -0.065502 0.1111 2627 -0.590 1.0000

(-0.951) - 0.924 0.064316 0.1150 2627 0.559 1.0000

(-0.951) - 0.951 -0.084183 0.1126 2627 -0.747 1.0000

NaN - 0.000 0.184348 0.0508 2627 3.626 0.0205

NaN - 0.383 0.366559 0.0778 2627 4.713 0.0002

NaN - 0.588 0.192532 0.0832 2627 2.315 0.5437

NaN - 0.707 0.220193 0.0476 2627 4.629 0.0003

NaN - 0.866 0.145450 0.0656 2627 2.218 0.6160

NaN - 0.924 0.275268 0.0710 2627 3.875 0.0082

NaN - 0.951 0.126768 0.0807 2627 1.572 0.9533

0.000 - 0.383 0.182210 0.0929 2627 1.961 0.7921

0.000 - 0.588 0.008183 0.0933 2627 0.088 1.0000

0.000 - 0.707 0.035844 0.0696 2627 0.515 1.0000

0.000 - 0.866 -0.038898 0.0766 2627 -0.508 1.0000

0.000 - 0.924 0.090919 0.0874 2627 1.041 0.9990

0.000 - 0.951 -0.057580 0.0907 2627 -0.635 1.0000

0.383 - 0.588 -0.174027 0.1139 2627 -1.528 0.9626

0.383 - 0.707 -0.146366 0.0912 2627 -1.605 0.9451

0.383 - 0.866 -0.221109 0.1017 2627 -2.173 0.6491

0.383 - 0.924 -0.091291 0.0966 2627 -0.945 0.9996

0.383 - 0.951 -0.239790 0.1121 2627 -2.140 0.6733

0.588 - 0.707 0.027661 0.0958 2627 0.289 1.0000

0.588 - 0.866 -0.047081 0.1052 2627 -0.448 1.0000

0.588 - 0.924 0.082736 0.1094 2627 0.756 1.0000

0.588 - 0.951 -0.065763 0.1062 2627 -0.619 1.0000

0.707 - 0.866 -0.074743 0.0810 2627 -0.923 0.9997

0.707 - 0.924 0.055075 0.0855 2627 0.644 1.0000

0.707 - 0.951 -0.093424 0.0936 2627 -0.998 0.9993

0.866 - 0.924 0.129818 0.0967 2627 1.343 0.9876

0.866 - 0.951 -0.018682 0.1031 2627 -0.181 1.0000

0.924 - 0.951 -0.148499 0.1075 2627 -1.382 0.9840

P value adjustment: tukey method for comparing a family of 14 estimates

> aov\_df1 <- aov(RTCorrect~ ypos1 + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ ypos1)

> pairs(emm)

contrast estimate SE df t.ratio p.value

(-0.309) - (-0.383) 0.08801 0.1186 2626 0.742 1.0000

(-0.309) - (-0.500) 0.07894 0.1060 2626 0.744 1.0000

(-0.309) - (-0.707) 0.02267 0.0999 2626 0.227 1.0000

(-0.309) - (-0.809) -0.14655 0.1171 2626 -1.251 0.9958

(-0.309) - (-0.924) -0.06611 0.1246 2626 -0.530 1.0000

(-0.309) - (-1.000) -0.12728 0.1179 2626 -1.080 0.9991

(-0.309) - NaN -0.16285 0.0873 2626 -1.865 0.8704

(-0.309) - 0.309 -0.00598 0.1115 2626 -0.054 1.0000

(-0.309) - 0.383 0.18726 0.1115 2626 1.680 0.9392

(-0.309) - 0.500 0.02552 0.1060 2626 0.241 1.0000

(-0.309) - 0.707 0.13849 0.0985 2626 1.405 0.9870

(-0.309) - 0.809 0.18162 0.1091 2626 1.665 0.9435

(-0.309) - 0.924 0.27168 0.1103 2626 2.463 0.4675

(-0.309) - 1.000 0.08698 0.1022 2626 0.851 0.9999

(-0.383) - (-0.500) -0.00907 0.1010 2626 -0.090 1.0000

(-0.383) - (-0.707) -0.06534 0.0937 2626 -0.697 1.0000

(-0.383) - (-0.809) -0.23457 0.1221 2626 -1.921 0.8429

(-0.383) - (-0.924) -0.15412 0.1129 2626 -1.366 0.9901

(-0.383) - (-1.000) -0.21529 0.1172 2626 -1.836 0.8833

(-0.383) - NaN -0.25086 0.0802 2626 -3.127 0.1100

(-0.383) - 0.309 -0.09399 0.1149 2626 -0.818 1.0000

(-0.383) - 0.383 0.09925 0.0978 2626 1.015 0.9996

(-0.383) - 0.500 -0.06249 0.1009 2626 -0.619 1.0000

(-0.383) - 0.707 0.05048 0.0923 2626 0.547 1.0000

(-0.383) - 0.809 0.09361 0.1142 2626 0.820 1.0000

(-0.383) - 0.924 0.18367 0.0969 2626 1.896 0.8553

(-0.383) - 1.000 -0.00103 0.0993 2626 -0.010 1.0000

(-0.500) - (-0.707) -0.05626 0.0782 2626 -0.720 1.0000

(-0.500) - (-0.809) -0.22549 0.1099 2626 -2.051 0.7670

(-0.500) - (-0.924) -0.14505 0.1080 2626 -1.343 0.9916

(-0.500) - (-1.000) -0.20622 0.1010 2626 -2.043 0.7725

(-0.500) - NaN -0.24179 0.0613 2626 -3.945 0.0072

(-0.500) - 0.309 -0.08492 0.1018 2626 -0.834 1.0000

(-0.500) - 0.383 0.10832 0.0925 2626 1.171 0.9979

(-0.500) - 0.500 -0.05342 0.0771 2626 -0.693 1.0000

(-0.500) - 0.707 0.05955 0.0764 2626 0.779 1.0000

(-0.500) - 0.809 0.10268 0.1010 2626 1.016 0.9996

(-0.500) - 0.924 0.19274 0.0911 2626 2.116 0.7241

(-0.500) - 1.000 0.00804 0.0785 2626 0.102 1.0000

(-0.707) - (-0.809) -0.16923 0.1041 2626 -1.626 0.9531

(-0.707) - (-0.924) -0.08878 0.1013 2626 -0.877 0.9999

(-0.707) - (-1.000) -0.14995 0.0983 2626 -1.526 0.9726

(-0.707) - NaN -0.18553 0.0485 2626 -3.826 0.0113

(-0.707) - 0.309 -0.02865 0.0955 2626 -0.300 1.0000

(-0.707) - 0.383 0.16459 0.0846 2626 1.946 0.8292

(-0.707) - 0.500 0.00285 0.0781 2626 0.036 1.0000

(-0.707) - 0.707 0.11582 0.0559 2626 2.073 0.7532

(-0.707) - 0.809 0.15895 0.0946 2626 1.680 0.9393

(-0.707) - 0.924 0.24901 0.0830 2626 3.000 0.1539

(-0.707) - 1.000 0.06431 0.0760 2626 0.846 1.0000

(-0.809) - (-0.924) 0.08045 0.1280 2626 0.628 1.0000

(-0.809) - (-1.000) 0.01928 0.1217 2626 0.158 1.0000

(-0.809) - NaN -0.01630 0.0921 2626 -0.177 1.0000

(-0.809) - 0.309 0.14058 0.1146 2626 1.226 0.9966

(-0.809) - 0.383 0.33382 0.1152 2626 2.897 0.1982

(-0.809) - 0.500 0.17208 0.1099 2626 1.565 0.9658

(-0.809) - 0.707 0.28505 0.1028 2626 2.773 0.2621

(-0.809) - 0.809 0.32818 0.1140 2626 2.878 0.2070

(-0.809) - 0.924 0.41824 0.1141 2626 3.666 0.0202

(-0.809) - 1.000 0.23354 0.1057 2626 2.210 0.6576

(-0.924) - (-1.000) -0.06117 0.1234 2626 -0.496 1.0000

(-0.924) - NaN -0.09675 0.0889 2626 -1.088 0.9991

(-0.924) - 0.309 0.06013 0.1212 2626 0.496 1.0000

(-0.924) - 0.383 0.25337 0.1046 2626 2.423 0.4980

(-0.924) - 0.500 0.09163 0.1080 2626 0.849 0.9999

(-0.924) - 0.707 0.20460 0.1000 2626 2.047 0.7701

(-0.924) - 0.809 0.24773 0.1205 2626 2.056 0.7637

(-0.924) - 0.924 0.33779 0.1023 2626 3.302 0.0665

(-0.924) - 1.000 0.15309 0.1065 2626 1.438 0.9838

(-1.000) - NaN -0.03558 0.0855 2626 -0.416 1.0000

(-1.000) - 0.309 0.12130 0.1150 2626 1.055 0.9993

(-1.000) - 0.383 0.31454 0.1100 2626 2.859 0.2167

(-1.000) - 0.500 0.15280 0.1008 2626 1.516 0.9741

(-1.000) - 0.707 0.26577 0.0969 2626 2.742 0.2800

(-1.000) - 0.809 0.30890 0.1140 2626 2.710 0.2989

(-1.000) - 0.924 0.39896 0.1088 2626 3.665 0.0202

(-1.000) - 1.000 0.21426 0.0983 2626 2.181 0.6790

NaN - 0.309 0.15687 0.0823 2626 1.906 0.8503

NaN - 0.383 0.35012 0.0693 2626 5.054 <.0001

NaN - 0.500 0.18838 0.0612 2626 3.076 0.1264

NaN - 0.707 0.30135 0.0457 2626 6.597 <.0001

NaN - 0.809 0.34448 0.0813 2626 4.239 0.0022

NaN - 0.924 0.43453 0.0674 2626 6.451 <.0001

NaN - 1.000 0.24984 0.0585 2626 4.270 0.0019

0.309 - 0.383 0.19324 0.1076 2626 1.796 0.8999

0.309 - 0.500 0.03150 0.1018 2626 0.309 1.0000

0.309 - 0.707 0.14447 0.0941 2626 1.535 0.9711

0.309 - 0.809 0.18760 0.1065 2626 1.761 0.9133

0.309 - 0.924 0.27766 0.1063 2626 2.611 0.3627

0.309 - 1.000 0.09296 0.0969 2626 0.959 0.9998

0.383 - 0.500 -0.16174 0.0925 2626 -1.749 0.9175

0.383 - 0.707 -0.04877 0.0830 2626 -0.588 1.0000

0.383 - 0.809 -0.00564 0.1068 2626 -0.053 1.0000

0.383 - 0.924 0.08442 0.0874 2626 0.965 0.9998

0.383 - 1.000 -0.10028 0.0907 2626 -1.106 0.9989

0.500 - 0.707 0.11297 0.0764 2626 1.479 0.9792

0.500 - 0.809 0.15610 0.1010 2626 1.545 0.9694

0.500 - 0.924 0.24616 0.0910 2626 2.704 0.3029

0.500 - 1.000 0.06146 0.0789 2626 0.778 1.0000

0.707 - 0.809 0.04313 0.0932 2626 0.463 1.0000

0.707 - 0.924 0.13319 0.0814 2626 1.636 0.9507

0.707 - 1.000 -0.05151 0.0742 2626 -0.694 1.0000

0.809 - 0.924 0.09006 0.1055 2626 0.853 0.9999

0.809 - 1.000 -0.09464 0.0964 2626 -0.982 0.9997

0.924 - 1.000 -0.18470 0.0892 2626 -2.070 0.7550

P value adjustment: tukey method for comparing a family of 15 estimates

> aov\_df1 <- aov(RTCorrect~ predictability + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ predictability)

> pairs(emm)

contrast estimate SE df t.ratio p.value

1 - 3 0.0141 0.0253 286 0.558 0.5775

> aov\_df1 <- aov(RTCorrect~ difficulty + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ difficulty)

> pairs(emm)

contrast estimate SE df t.ratio p.value

4 - 6 -0.14577 0.0270 284 -5.405 <.0001

4 - 8 -0.25382 0.0280 284 -9.063 <.0001

4 - 10 -0.25016 0.0288 284 -8.694 <.0001

6 - 8 -0.10805 0.0292 284 -3.704 0.0014

6 - 10 -0.10439 0.0299 284 -3.491 0.0031

8 - 10 0.00366 0.0308 284 0.118 0.9994

P value adjustment: tukey method for comparing a family of 4 estimates

> aov\_df1 <- aov(RTCorrect~ perfGrp + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ perfGrp)

> pairs(emm)

contrast estimate SE df t.ratio p.value

1 - 2 -0.0472 0.0213 2639 -2.213 0.0270

## score

> df1.aov <- aov(score ~ xpos1 \* ypos1\*predictability\*difficulty\*perfGrp + Error(code), data = df1)

> summary(df1.aov)

Error: code

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

**xpos1 13 55.56 4.274 25.520 < 2e-16 \*\*\***

ypos1 7 1.57 0.225 1.343 0.233386

predictability 1 0.02 0.024 0.143 0.705787

**difficulty 3 3.36 1.119 6.683 0.000277 \*\*\***

perfGrp 1 0.31 0.314 1.873 0.173058

**xpos1:ypos1 6 2.20 0.366 2.187 0.046712 \***

xpos1:predictability 13 1.31 0.101 0.602 0.850070

ypos1:predictability 7 0.64 0.091 0.543 0.800623

xpos1:difficulty 1 0.08 0.082 0.489 0.485296

ypos1:difficulty 1 0.35 0.353 2.110 0.148208

predictability:difficulty 3 0.04 0.014 0.083 0.969318

xpos1:perfGrp 13 1.86 0.143 0.855 0.601584

ypos1:perfGrp 7 1.87 0.267 1.591 0.141283

difficulty:perfGrp 3 0.45 0.150 0.894 0.445858

**xpos1:ypos1:predictability 6 2.15 0.358 2.138 0.051712 .**

xpos1:predictability:difficulty 1 0.03 0.030 0.177 0.674236

ypos1:predictability:difficulty 1 0.06 0.057 0.339 0.561077

xpos1:ypos1:perfGrp 6 1.36 0.227 1.353 0.236497

xpos1:predictability:perfGrp 13 2.55 0.196 1.172 0.303823

ypos1:predictability:perfGrp 7 0.60 0.085 0.508 0.827902

xpos1:difficulty:perfGrp 1 0.10 0.096 0.575 0.449262

ypos1:difficulty:perfGrp 1 0.00 0.003 0.018 0.894381

xpos1:ypos1:predictability:perfGrp 6 0.28 0.047 0.283 0.944138

xpos1:predictability:difficulty:perfGrp 1 0.00 0.001 0.005 0.946486

ypos1:predictability:difficulty:perfGrp 1 0.37 0.370 2.210 0.139074

Residuals 164 27.47 0.167

---

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

Error: Within

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

**xpos1 13 20.1 1.545 9.845 < 2e-16 \*\*\***

**ypos1 7 28.5 4.066 25.908 < 2e-16 \*\*\***

perfGrp 1 0.1 0.079 0.503 0.47811

**xpos1:ypos1 6 5.7 0.957 6.098 2.29e-06 \*\*\***

xpos1:predictability 13 2.4 0.183 1.166 0.29831

ypos1:predictability 7 0.2 0.023 0.145 0.99453

xpos1:difficulty 1 0.1 0.119 0.760 0.38327

**ypos1:difficulty 1 1.3 1.266 8.068 0.00453 \*\***

xpos1:perfGrp 13 2.6 0.200 1.276 0.21950

ypos1:perfGrp 7 1.3 0.182 1.162 0.32094

predictability:perfGrp 1 0.3 0.308 1.962 0.16136

difficulty:perfGrp 3 0.2 0.080 0.509 0.67623

**xpos1:ypos1:predictability 6 1.8 0.299 1.904 0.07652 .**

xpos1:predictability:difficulty 1 0.0 0.000 0.001 0.97447

ypos1:predictability:difficulty 1 0.1 0.085 0.541 0.46208

xpos1:ypos1:perfGrp 6 1.2 0.197 1.256 0.27419

xpos1:predictability:perfGrp 13 2.2 0.173 1.099 0.35417

ypos1:predictability:perfGrp 7 1.4 0.198 1.262 0.26495

xpos1:difficulty:perfGrp 1 0.1 0.142 0.904 0.34176

ypos1:difficulty:perfGrp 1 0.0 0.008 0.053 0.81818

predictability:difficulty:perfGrp 3 0.4 0.139 0.886 0.44749

xpos1:ypos1:predictability:perfGrp 6 1.6 0.273 1.739 0.10797

**xpos1:predictability:difficulty:perfGrp 1 0.6 0.568 3.617 0.05729 .**

ypos1:predictability:difficulty:perfGrp 1 0.1 0.066 0.419 0.51738

Residuals 3480 546.1 0.157

---

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

> aov\_df1 <- aov(score~ xpos1 + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ xpos1)

> pairs(emm)

contrast estimate SE df t.ratio p.value

(-0.383) - (-0.588) 0.05022 0.0616 3587 0.815 0.9999

(-0.383) - (-0.707) -0.15271 0.0537 3587 -2.842 0.2042

(-0.383) - (-0.866) -0.07964 0.0567 3587 -1.404 0.9816

(-0.383) - (-0.924) -0.00864 0.0540 3587 -0.160 1.0000

(-0.383) - (-0.951) -0.01037 0.0637 3587 -0.163 1.0000

(-0.383) - NaN -0.17139 0.0421 3587 -4.071 0.0038

(-0.383) - 0.000 0.00783 0.0515 3587 0.152 1.0000

(-0.383) - 0.383 -0.00534 0.0544 3587 -0.098 1.0000

(-0.383) - 0.588 -0.08674 0.0633 3587 -1.370 0.9852

(-0.383) - 0.707 -0.08932 0.0536 3587 -1.665 0.9279

(-0.383) - 0.866 0.04020 0.0575 3587 0.699 1.0000

(-0.383) - 0.924 -0.02761 0.0533 3587 -0.518 1.0000

(-0.383) - 0.951 -0.05250 0.0618 3587 -0.850 0.9999

(-0.588) - (-0.707) -0.20293 0.0560 3587 -3.621 0.0208

(-0.588) - (-0.866) -0.12987 0.0583 3587 -2.229 0.6080

(-0.588) - (-0.924) -0.05886 0.0625 3587 -0.941 0.9997

(-0.588) - (-0.951) -0.06059 0.0601 3587 -1.008 0.9993

(-0.588) - NaN -0.22161 0.0450 3587 -4.924 0.0001

(-0.588) - 0.000 -0.04239 0.0508 3587 -0.835 0.9999

(-0.588) - 0.383 -0.05556 0.0631 3587 -0.881 0.9998

(-0.588) - 0.588 -0.13697 0.0594 3587 -2.308 0.5492

(-0.588) - 0.707 -0.13955 0.0560 3587 -2.494 0.4124

(-0.588) - 0.866 -0.01002 0.0590 3587 -0.170 1.0000

(-0.588) - 0.924 -0.07783 0.0614 3587 -1.268 0.9927

(-0.588) - 0.951 -0.10273 0.0577 3587 -1.781 0.8850

(-0.707) - (-0.866) 0.07306 0.0506 3587 1.444 0.9766

(-0.707) - (-0.924) 0.14407 0.0548 3587 2.630 0.3217

(-0.707) - (-0.951) 0.14233 0.0583 3587 2.440 0.4510

(-0.707) - NaN -0.01868 0.0334 3587 -0.559 1.0000

(-0.707) - 0.000 0.16054 0.0447 3587 3.589 0.0232

(-0.707) - 0.383 0.14737 0.0554 3587 2.660 0.3028

(-0.707) - 0.588 0.06596 0.0579 3587 1.139 0.9974

(-0.707) - 0.707 0.06338 0.0390 3587 1.626 0.9395

(-0.707) - 0.866 0.19291 0.0515 3587 3.746 0.0133

(-0.707) - 0.924 0.12510 0.0535 3587 2.340 0.5253

(-0.707) - 0.951 0.10020 0.0562 3587 1.783 0.8842

(-0.866) - (-0.924) 0.07101 0.0577 3587 1.230 0.9945

(-0.866) - (-0.951) 0.06927 0.0605 3587 1.145 0.9973

(-0.866) - NaN -0.09174 0.0380 3587 -2.414 0.4703

(-0.866) - 0.000 0.08747 0.0438 3587 1.996 0.7708

(-0.866) - 0.383 0.07431 0.0583 3587 1.275 0.9923

(-0.866) - 0.588 -0.00710 0.0601 3587 -0.118 1.0000

(-0.866) - 0.707 -0.00968 0.0505 3587 -0.192 1.0000

(-0.866) - 0.866 0.11985 0.0483 3587 2.481 0.4217

(-0.866) - 0.924 0.05204 0.0565 3587 0.922 0.9997

(-0.866) - 0.951 0.02714 0.0584 3587 0.465 1.0000

(-0.924) - (-0.951) -0.00173 0.0646 3587 -0.027 1.0000

(-0.924) - NaN -0.16275 0.0434 3587 -3.747 0.0132

(-0.924) - 0.000 0.01647 0.0526 3587 0.313 1.0000

(-0.924) - 0.383 0.00330 0.0555 3587 0.059 1.0000

(-0.924) - 0.588 -0.07810 0.0642 3587 -1.216 0.9951

(-0.924) - 0.707 -0.08069 0.0547 3587 -1.475 0.9720

(-0.924) - 0.866 0.04884 0.0585 3587 0.835 0.9999

(-0.924) - 0.924 -0.01897 0.0538 3587 -0.352 1.0000

(-0.924) - 0.951 -0.04386 0.0627 3587 -0.700 1.0000

(-0.951) - NaN -0.16102 0.0478 3587 -3.367 0.0484

(-0.951) - 0.000 0.01820 0.0534 3587 0.341 1.0000

(-0.951) - 0.383 0.00503 0.0651 3587 0.077 1.0000

(-0.951) - 0.588 -0.07637 0.0618 3587 -1.236 0.9943

(-0.951) - 0.707 -0.07895 0.0583 3587 -1.355 0.9865

(-0.951) - 0.866 0.05057 0.0612 3587 0.826 0.9999

(-0.951) - 0.924 -0.01724 0.0635 3587 -0.272 1.0000

(-0.951) - 0.951 -0.04213 0.0606 3587 -0.695 1.0000

NaN - 0.000 0.17922 0.0297 3587 6.024 <.0001

NaN - 0.383 0.16605 0.0442 3587 3.757 0.0128

NaN - 0.588 0.08464 0.0473 3587 1.789 0.8814

NaN - 0.707 0.08206 0.0333 3587 2.468 0.4308

NaN - 0.866 0.21159 0.0392 3587 5.399 <.0001

NaN - 0.924 0.14378 0.0418 3587 3.443 0.0379

NaN - 0.951 0.11888 0.0452 3587 2.629 0.3218

0.000 - 0.383 -0.01317 0.0533 3587 -0.247 1.0000

0.000 - 0.588 -0.09457 0.0529 3587 -1.787 0.8821

0.000 - 0.707 -0.09715 0.0446 3587 -2.177 0.6462

0.000 - 0.866 0.03237 0.0447 3587 0.724 1.0000

0.000 - 0.924 -0.03544 0.0513 3587 -0.691 1.0000

0.000 - 0.951 -0.06033 0.0508 3587 -1.187 0.9961

0.383 - 0.588 -0.08140 0.0647 3587 -1.257 0.9933

0.383 - 0.707 -0.08398 0.0553 3587 -1.518 0.9645

0.383 - 0.866 0.04554 0.0591 3587 0.771 1.0000

0.383 - 0.924 -0.02227 0.0545 3587 -0.409 1.0000

0.383 - 0.951 -0.04716 0.0632 3587 -0.746 1.0000

0.588 - 0.707 -0.00258 0.0578 3587 -0.045 1.0000

0.588 - 0.866 0.12694 0.0608 3587 2.088 0.7101

0.588 - 0.924 0.05913 0.0631 3587 0.937 0.9997

0.588 - 0.951 0.03424 0.0596 3587 0.574 1.0000

0.707 - 0.866 0.12952 0.0514 3587 2.520 0.3941

0.707 - 0.924 0.06171 0.0534 3587 1.156 0.9970

0.707 - 0.951 0.03682 0.0561 3587 0.656 1.0000

0.866 - 0.924 -0.06781 0.0573 3587 -1.184 0.9962

0.866 - 0.951 -0.09270 0.0591 3587 -1.567 0.9543

0.924 - 0.951 -0.02489 0.0615 3587 -0.404 1.0000

P value adjustment: tukey method for comparing a family of 14 estimates

> aov\_df1 <- aov(score~ ypos1 + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ ypos1)

> pairs(emm)

contrast estimate SE df t.ratio p.value

(-0.309) - (-0.383) 0.122750 0.0624 3586 1.967 0.8177

(-0.309) - (-0.500) 0.068575 0.0587 3586 1.169 0.9980

(-0.309) - (-0.707) -0.033245 0.0575 3586 -0.578 1.0000

(-0.309) - (-0.809) 0.130334 0.0591 3586 2.205 0.6614

(-0.309) - (-0.924) 0.233751 0.0626 3586 3.732 0.0159

(-0.309) - (-1.000) 0.251643 0.0592 3586 4.250 0.0020

(-0.309) - NaN -0.142001 0.0471 3586 -3.017 0.1474

(-0.309) - 0.309 -0.005935 0.0595 3586 -0.100 1.0000

(-0.309) - 0.383 -0.106560 0.0634 3586 -1.682 0.9388

(-0.309) - 0.500 -0.065699 0.0606 3586 -1.085 0.9991

(-0.309) - 0.707 -0.146208 0.0571 3586 -2.561 0.3969

(-0.309) - 0.809 -0.108661 0.0603 3586 -1.802 0.8977

(-0.309) - 0.924 -0.200215 0.0637 3586 -3.145 0.1045

(-0.309) - 1.000 -0.146972 0.0579 3586 -2.538 0.4129

(-0.383) - (-0.500) -0.054174 0.0545 3586 -0.994 0.9997

(-0.383) - (-0.707) -0.155995 0.0526 3586 -2.967 0.1671

(-0.383) - (-0.809) 0.007584 0.0604 3586 0.126 1.0000

(-0.383) - (-0.924) 0.111001 0.0517 3586 2.146 0.7034

(-0.383) - (-1.000) 0.128894 0.0574 3586 2.246 0.6308

(-0.383) - NaN -0.264751 0.0410 3586 -6.464 <.0001

(-0.383) - 0.309 -0.128685 0.0602 3586 -2.138 0.7090

(-0.383) - 0.383 -0.229310 0.0528 3586 -4.345 0.0014

(-0.383) - 0.500 -0.188449 0.0566 3586 -3.331 0.0607

(-0.383) - 0.707 -0.268958 0.0522 3586 -5.157 <.0001

(-0.383) - 0.809 -0.231411 0.0614 3586 -3.766 0.0140

(-0.383) - 0.924 -0.322965 0.0533 3586 -6.063 <.0001

(-0.383) - 1.000 -0.269722 0.0556 3586 -4.849 0.0001

(-0.500) - (-0.707) -0.101820 0.0488 3586 -2.086 0.7446

(-0.500) - (-0.809) 0.061759 0.0564 3586 1.094 0.9990

(-0.500) - (-0.924) 0.165176 0.0548 3586 3.014 0.1482

(-0.500) - (-1.000) 0.183068 0.0501 3586 3.652 0.0211

(-0.500) - NaN -0.210576 0.0360 3586 -5.851 <.0001

(-0.500) - 0.309 -0.074510 0.0562 3586 -1.325 0.9926

(-0.500) - 0.383 -0.175135 0.0556 3586 -3.148 0.1037

(-0.500) - 0.500 -0.134274 0.0463 3586 -2.898 0.1976

(-0.500) - 0.707 -0.214783 0.0484 3586 -4.441 0.0009

(-0.500) - 0.809 -0.177237 0.0576 3586 -3.076 0.1261

(-0.500) - 0.924 -0.268791 0.0560 3586 -4.803 0.0002

(-0.500) - 1.000 -0.215548 0.0480 3586 -4.488 0.0007

(-0.707) - (-0.809) 0.163579 0.0552 3586 2.961 0.1696

(-0.707) - (-0.924) 0.266996 0.0529 3586 5.051 <.0001

(-0.707) - (-1.000) 0.284888 0.0520 3586 5.480 <.0001

(-0.707) - NaN -0.108756 0.0330 3586 -3.298 0.0671

(-0.707) - 0.309 0.027310 0.0551 3586 0.496 1.0000

(-0.707) - 0.383 -0.073315 0.0537 3586 -1.365 0.9902

(-0.707) - 0.500 -0.032454 0.0511 3586 -0.635 1.0000

(-0.707) - 0.707 -0.112963 0.0383 3586 -2.951 0.1737

(-0.707) - 0.809 -0.075417 0.0564 3586 -1.336 0.9920

(-0.707) - 0.924 -0.166970 0.0541 3586 -3.088 0.1222

(-0.707) - 1.000 -0.113727 0.0500 3586 -2.273 0.6110

(-0.809) - (-0.924) 0.103417 0.0606 3586 1.707 0.9315

(-0.809) - (-1.000) 0.121310 0.0572 3586 2.122 0.7204

(-0.809) - NaN -0.272335 0.0443 3586 -6.143 <.0001

(-0.809) - 0.309 -0.136269 0.0567 3586 -2.404 0.5120

(-0.809) - 0.383 -0.236894 0.0614 3586 -3.861 0.0098

(-0.809) - 0.500 -0.196033 0.0584 3586 -3.354 0.0565

(-0.809) - 0.707 -0.276542 0.0548 3586 -5.042 <.0001

(-0.809) - 0.809 -0.238995 0.0579 3586 -4.131 0.0034

(-0.809) - 0.924 -0.330549 0.0617 3586 -5.361 <.0001

(-0.809) - 1.000 -0.277306 0.0553 3586 -5.012 0.0001

(-0.924) - (-1.000) 0.017892 0.0576 3586 0.310 1.0000

(-0.924) - NaN -0.375752 0.0413 3586 -9.094 <.0001

(-0.924) - 0.309 -0.239686 0.0604 3586 -3.966 0.0065

(-0.924) - 0.383 -0.340311 0.0529 3586 -6.429 <.0001

(-0.924) - 0.500 -0.299450 0.0568 3586 -5.269 <.0001

(-0.924) - 0.707 -0.379959 0.0524 3586 -7.245 <.0001

(-0.924) - 0.809 -0.342413 0.0617 3586 -5.551 <.0001

(-0.924) - 0.924 -0.433966 0.0529 3586 -8.204 <.0001

(-0.924) - 1.000 -0.380723 0.0559 3586 -6.812 <.0001

(-1.000) - NaN -0.393644 0.0402 3586 -9.796 <.0001

(-1.000) - 0.309 -0.257578 0.0570 3586 -4.522 0.0006

(-1.000) - 0.383 -0.358204 0.0584 3586 -6.130 <.0001

(-1.000) - 0.500 -0.317343 0.0522 3586 -6.080 <.0001

(-1.000) - 0.707 -0.397851 0.0516 3586 -7.717 <.0001

(-1.000) - 0.809 -0.360305 0.0583 3586 -6.183 <.0001

(-1.000) - 0.924 -0.451859 0.0587 3586 -7.692 <.0001

(-1.000) - 1.000 -0.398616 0.0516 3586 -7.726 <.0001

NaN - 0.309 0.136066 0.0441 3586 3.086 0.1230

NaN - 0.383 0.035441 0.0424 3586 0.835 1.0000

NaN - 0.500 0.076302 0.0390 3586 1.955 0.8245

NaN - 0.707 -0.004207 0.0323 3586 -0.130 1.0000

NaN - 0.809 0.033340 0.0458 3586 0.728 1.0000

NaN - 0.924 -0.058215 0.0429 3586 -1.358 0.9906

NaN - 1.000 -0.004972 0.0376 3586 -0.132 1.0000

0.309 - 0.383 -0.100625 0.0612 3586 -1.644 0.9487

0.309 - 0.500 -0.059764 0.0582 3586 -1.026 0.9995

0.309 - 0.707 -0.140273 0.0547 3586 -2.566 0.3932

0.309 - 0.809 -0.102726 0.0579 3586 -1.775 0.9083

0.309 - 0.924 -0.194280 0.0615 3586 -3.160 0.1004

0.309 - 1.000 -0.141038 0.0549 3586 -2.571 0.3899

0.383 - 0.500 0.040861 0.0576 3586 0.709 1.0000

0.383 - 0.707 -0.039648 0.0533 3586 -0.744 1.0000

0.383 - 0.809 -0.002101 0.0624 3586 -0.034 1.0000

0.383 - 0.924 -0.093655 0.0544 3586 -1.722 0.9266

0.383 - 1.000 -0.040412 0.0567 3586 -0.713 1.0000

0.500 - 0.707 -0.080509 0.0507 3586 -1.589 0.9612

0.500 - 0.809 -0.042962 0.0596 3586 -0.721 1.0000

0.500 - 0.924 -0.134516 0.0580 3586 -2.321 0.5749

0.500 - 1.000 -0.081273 0.0507 3586 -1.603 0.9583

0.707 - 0.809 0.037546 0.0560 3586 0.670 1.0000

0.707 - 0.924 -0.054007 0.0537 3586 -1.006 0.9996

0.707 - 1.000 -0.000764 0.0496 3586 -0.015 1.0000

0.809 - 0.924 -0.091554 0.0627 3586 -1.460 0.9815

0.809 - 1.000 -0.038311 0.0567 3586 -0.676 1.0000

0.924 - 1.000 0.053243 0.0570 3586 0.934 0.9998

P value adjustment: tukey method for comparing a family of 15 estimates

> aov\_df1 <- aov(score~ predictability + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ predictability)

> pairs(emm)

contrast estimate SE df t.ratio p.value

1 - 3 0.0104 0.0206 286 0.507 0.6129

> aov\_df1 <- aov(score~ difficulty + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ difficulty)

> pairs(emm)

contrast estimate SE df t.ratio p.value

4 - 6 0.1564 0.019 284 8.230 <.0001

4 - 8 0.2541 0.019 284 13.374 <.0001

4 - 10 0.3138 0.019 284 16.515 <.0001

6 - 8 0.0977 0.019 284 5.144 <.0001

6 - 10 0.1574 0.019 284 8.284 <.0001

8 - 10 0.0597 0.019 284 3.140 0.0100

P value adjustment: tukey method for comparing a family of 4 estimates

> aov\_df1 <- aov(score~ perfGrp + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ perfGrp)

> pairs(emm)

contrast estimate SE df t.ratio p.value

1 - 2 0.0171 0.0134 3599 1.278 0.2015

## IES

## Confidence

> df1.aov <- aov(confidence ~ xpos1 \* ypos1\*predictability\*difficulty\*perfGrp + Error(code), data = df1)

> summary(df1.aov)

Error: code

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

**xpos1 13 991.7 76.28 131.430 < 2e-16 \*\*\***

**ypos1 7 13.4 1.92 3.306 0.00258 \*\***

predictability 1 0.1 0.08 0.137 0.71145

**difficulty 3 111.7 37.25 64.173 < 2e-16 \*\*\***

perfGrp 1 0.2 0.19 0.331 0.56575

xpos1:ypos1 6 2.9 0.48 0.830 0.54832

xpos1:predictability 13 5.5 0.43 0.734 0.72795

**ypos1:predictability 7 14.1 2.01 3.464 0.00175 \*\***

xpos1:difficulty 1 0.0 0.01 0.016 0.90027

ypos1:difficulty 1 0.4 0.41 0.708 0.40136

predictability:difficulty 3 0.5 0.17 0.295 0.82880

xpos1:perfGrp 13 14.3 1.10 1.900 0.03342 \*

ypos1:perfGrp 7 3.2 0.45 0.783 0.60210

predictability:perfGrp 1 0.2 0.18 0.308 0.57943

difficulty:perfGrp 3 2.2 0.73 1.256 0.29148

**xpos1:ypos1:predictability 6 10.2 1.70 2.922 0.00985 \*\***

xpos1:predictability:difficulty 1 0.3 0.28 0.481 0.48909

ypos1:predictability:difficulty 1 0.2 0.21 0.358 0.55051

xpos1:ypos1:perfGrp 6 2.2 0.37 0.636 0.70145

xpos1:predictability:perfGrp 13 8.7 0.67 1.156 0.31644

ypos1:predictability:perfGrp 7 8.0 1.14 1.963 0.06320 .

xpos1:difficulty:perfGrp 1 0.0 0.03 0.046 0.83004

ypos1:difficulty:perfGrp 1 0.0 0.01 0.014 0.90657

predictability:difficulty:perfGrp 1 0.0 0.03 0.057 0.81091

xpos1:ypos1:predictability:perfGrp 6 3.6 0.60 1.037 0.40306

xpos1:predictability:difficulty:perfGrp 1 0.1 0.06 0.098 0.75422

ypos1:predictability:difficulty:perfGrp 1 0.9 0.86 1.478 0.22581

Residuals 162 94.0 0.58

---

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

Error: Within

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

xpos1 13 223.6 17.201 23.364 < 2e-16 \*\*\*

ypos1 7 159.4 22.772 30.930 < 2e-16 \*\*\*

perfGrp 1 4.9 4.936 6.705 0.00966 \*\*

xpos1:ypos1 6 7.7 1.288 1.750 0.10549

xpos1:predictability 13 18.6 1.431 1.943 0.02164 \*

ypos1:predictability 7 8.0 1.148 1.560 0.14267

xpos1:difficulty 1 0.3 0.303 0.412 0.52122

ypos1:difficulty 1 0.9 0.865 1.174 0.27857

xpos1:perfGrp 13 14.4 1.111 1.510 0.10566

ypos1:perfGrp 7 3.4 0.486 0.661 0.70577

predictability:perfGrp 1 0.5 0.532 0.723 0.39519

difficulty:perfGrp 3 1.8 0.590 0.801 0.49298

xpos1:ypos1:predictability 6 1.2 0.208 0.282 0.94549

xpos1:predictability:difficulty 1 0.0 0.025 0.034 0.85397

ypos1:predictability:difficulty 1 0.9 0.876 1.190 0.27534

xpos1:ypos1:perfGrp 6 4.9 0.809 1.099 0.36011

xpos1:predictability:perfGrp 13 14.2 1.090 1.481 0.11632

ypos1:predictability:perfGrp 7 2.6 0.373 0.506 0.83044

xpos1:difficulty:perfGrp 1 0.0 0.037 0.051 0.82210

ypos1:difficulty:perfGrp 1 0.1 0.054 0.074 0.78628

predictability:difficulty:perfGrp 3 2.4 0.811 1.102 0.34703

**xpos1:ypos1:predictability:perfGrp 6 9.4 1.559 2.117 0.04829 \***

xpos1:predictability:difficulty:perfGrp 1 0.3 0.339 0.460 0.49749

ypos1:predictability:difficulty:perfGrp 1 2.1 2.129 2.892 0.08911 .

Residuals 3475 2558.4 0.736

---

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

> aov\_df1 <- aov(confidence~ xpos1 + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ xpos1)

> pairs(emm)

contrast estimate SE df t.ratio p.value

(-0.383) - (-0.588) -0.01847 0.1338 3582 -0.138 1.0000

(-0.383) - (-0.707) 0.17102 0.1167 3582 1.466 0.9735

(-0.383) - (-0.866) -0.08410 0.1232 3582 -0.683 1.0000

(-0.383) - (-0.924) -0.21981 0.1172 3582 -1.875 0.8399

(-0.383) - (-0.951) 0.15619 0.1384 3582 1.129 0.9977

(-0.383) - NaN 0.48580 0.0914 3582 5.315 <.0001

(-0.383) - 0.000 0.00618 0.1120 3582 0.055 1.0000

(-0.383) - 0.383 -0.19688 0.1184 3582 -1.662 0.9288

(-0.383) - 0.588 -0.35233 0.1376 3582 -2.561 0.3660

(-0.383) - 0.707 0.28698 0.1165 3582 2.464 0.4338

(-0.383) - 0.866 0.15042 0.1249 3582 1.204 0.9955

(-0.383) - 0.924 -0.00542 0.1157 3582 -0.047 1.0000

(-0.383) - 0.951 0.02428 0.1342 3582 0.181 1.0000

(-0.588) - (-0.707) 0.18950 0.1217 3582 1.557 0.9567

(-0.588) - (-0.866) -0.06563 0.1265 3582 -0.519 1.0000

(-0.588) - (-0.924) -0.20133 0.1358 3582 -1.482 0.9709

(-0.588) - (-0.951) 0.17467 0.1305 3582 1.338 0.9880

(-0.588) - NaN 0.50428 0.0977 3582 5.159 <.0001

(-0.588) - 0.000 0.02466 0.1103 3582 0.223 1.0000

(-0.588) - 0.383 -0.17841 0.1372 3582 -1.300 0.9908

(-0.588) - 0.588 -0.33386 0.1289 3582 -2.590 0.3467

(-0.588) - 0.707 0.30545 0.1215 3582 2.514 0.3985

(-0.588) - 0.866 0.16890 0.1282 3582 1.318 0.9896

(-0.588) - 0.924 0.01306 0.1333 3582 0.098 1.0000

(-0.588) - 0.951 0.04275 0.1253 3582 0.341 1.0000

(-0.707) - (-0.866) -0.25512 0.1099 3582 -2.321 0.5389

(-0.707) - (-0.924) -0.39083 0.1190 3582 -3.285 0.0621

(-0.707) - (-0.951) -0.01483 0.1267 3582 -0.117 1.0000

(-0.707) - NaN 0.31478 0.0725 3582 4.341 0.0012

(-0.707) - 0.000 -0.16484 0.0972 3582 -1.696 0.9176

(-0.707) - 0.383 -0.36790 0.1206 3582 -3.051 0.1210

(-0.707) - 0.588 -0.52336 0.1258 3582 -4.160 0.0026

(-0.707) - 0.707 0.11595 0.0846 3582 1.370 0.9852

(-0.707) - 0.866 -0.02060 0.1118 3582 -0.184 1.0000

(-0.707) - 0.924 -0.17644 0.1161 3582 -1.520 0.9643

(-0.707) - 0.951 -0.14675 0.1221 3582 -1.202 0.9956

(-0.866) - (-0.924) -0.13571 0.1254 3582 -1.083 0.9985

(-0.866) - (-0.951) 0.24029 0.1314 3582 1.829 0.8631

(-0.866) - NaN 0.56990 0.0826 3582 6.901 <.0001

(-0.866) - 0.000 0.09028 0.0953 3582 0.948 0.9996

(-0.866) - 0.383 -0.11278 0.1269 3582 -0.889 0.9998

(-0.866) - 0.588 -0.26823 0.1305 3582 -2.055 0.7322

(-0.866) - 0.707 0.37108 0.1097 3582 3.383 0.0459

(-0.866) - 0.866 0.23452 0.1049 3582 2.236 0.6032

(-0.866) - 0.924 0.07868 0.1226 3582 0.642 1.0000

(-0.866) - 0.951 0.10838 0.1268 3582 0.854 0.9999

(-0.924) - (-0.951) 0.37600 0.1403 3582 2.680 0.2907

(-0.924) - NaN 0.70561 0.0943 3582 7.482 <.0001

(-0.924) - 0.000 0.22599 0.1144 3582 1.976 0.7828

(-0.924) - 0.383 0.02293 0.1209 3582 0.190 1.0000

(-0.924) - 0.588 -0.13253 0.1395 3582 -0.950 0.9996

(-0.924) - 0.707 0.50678 0.1188 3582 4.267 0.0017

(-0.924) - 0.866 0.37023 0.1270 3582 2.914 0.1717

(-0.924) - 0.924 0.21439 0.1169 3582 1.834 0.8609

(-0.924) - 0.951 0.24408 0.1362 3582 1.793 0.8798

(-0.951) - NaN 0.32961 0.1039 3582 3.173 0.0864

(-0.951) - 0.000 -0.15001 0.1160 3582 -1.293 0.9912

(-0.951) - 0.383 -0.35307 0.1417 3582 -2.492 0.4135

(-0.951) - 0.588 -0.50853 0.1342 3582 -3.790 0.0113

(-0.951) - 0.707 0.13079 0.1265 3582 1.034 0.9991

(-0.951) - 0.866 -0.00577 0.1329 3582 -0.043 1.0000

(-0.951) - 0.924 -0.16161 0.1379 3582 -1.172 0.9966

(-0.951) - 0.951 -0.13192 0.1315 3582 -1.003 0.9993

NaN - 0.000 -0.47962 0.0647 3582 -7.415 <.0001

NaN - 0.383 -0.68268 0.0963 3582 -7.087 <.0001

NaN - 0.588 -0.83814 0.1028 3582 -8.153 <.0001

NaN - 0.707 -0.19883 0.0722 3582 -2.754 0.2488

NaN - 0.866 -0.33538 0.0851 3582 -3.941 0.0064

NaN - 0.924 -0.49122 0.0907 3582 -5.418 <.0001

NaN - 0.951 -0.46153 0.0982 3582 -4.699 0.0002

0.000 - 0.383 -0.20306 0.1160 3582 -1.750 0.8976

0.000 - 0.588 -0.35852 0.1150 3582 -3.119 0.1008

0.000 - 0.707 0.28079 0.0969 3582 2.897 0.1793

0.000 - 0.866 0.14424 0.0972 3582 1.484 0.9706

0.000 - 0.924 -0.01160 0.1114 3582 -0.104 1.0000

0.000 - 0.951 0.01809 0.1104 3582 0.164 1.0000

0.383 - 0.588 -0.15545 0.1409 3582 -1.103 0.9981

0.383 - 0.707 0.48386 0.1204 3582 4.019 0.0046

0.383 - 0.866 0.34730 0.1285 3582 2.702 0.2780

0.383 - 0.924 0.19146 0.1185 3582 1.615 0.9424

0.383 - 0.951 0.22116 0.1376 3582 1.608 0.9445

0.588 - 0.707 0.63931 0.1256 3582 5.089 <.0001

0.588 - 0.866 0.50276 0.1321 3582 3.806 0.0106

0.588 - 0.924 0.34692 0.1371 3582 2.531 0.3867

0.588 - 0.951 0.37661 0.1295 3582 2.908 0.1747

0.707 - 0.866 -0.13655 0.1116 3582 -1.224 0.9948

0.707 - 0.924 -0.29240 0.1159 3582 -2.523 0.3922

0.707 - 0.951 -0.26270 0.1219 3582 -2.155 0.6623

0.866 - 0.924 -0.15584 0.1244 3582 -1.253 0.9935

0.866 - 0.951 -0.12615 0.1285 3582 -0.982 0.9995

0.924 - 0.951 0.02969 0.1337 3582 0.222 1.0000

P value adjustment: tukey method for comparing a family of 14 estimates

> aov\_df1 <- aov(confidence~ ypos1 + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ ypos1)

> pairs(emm)

contrast estimate SE df t.ratio p.value

(-0.309) - (-0.383) -0.03217 0.1350 3581 -0.238 1.0000

(-0.309) - (-0.500) -0.19690 0.1269 3581 -1.551 0.9684

(-0.309) - (-0.707) 0.06234 0.1244 3581 0.501 1.0000

(-0.309) - (-0.809) -0.03249 0.1279 3581 -0.254 1.0000

(-0.309) - (-0.924) 0.19824 0.1357 3581 1.461 0.9814

(-0.309) - (-1.000) 0.13224 0.1282 3581 1.031 0.9995

(-0.309) - NaN 0.24175 0.1019 3581 2.373 0.5351

(-0.309) - 0.309 -0.29232 0.1287 3581 -2.271 0.6128

(-0.309) - 0.383 -0.68473 0.1371 3581 -4.994 0.0001

(-0.309) - 0.500 -0.23446 0.1311 3581 -1.788 0.9031

(-0.309) - 0.707 -0.08720 0.1235 3581 -0.706 1.0000

(-0.309) - 0.809 -0.83753 0.1305 3581 -6.418 <.0001

(-0.309) - 0.924 -0.91274 0.1377 3581 -6.627 <.0001

(-0.309) - 1.000 -0.55661 0.1253 3581 -4.443 0.0009

(-0.383) - (-0.500) -0.16473 0.1180 3581 -1.396 0.9878

(-0.383) - (-0.707) 0.09451 0.1138 3581 0.831 1.0000

(-0.383) - (-0.809) -0.00032 0.1306 3581 -0.002 1.0000

(-0.383) - (-0.924) 0.23041 0.1121 3581 2.056 0.7644

(-0.383) - (-1.000) 0.16441 0.1243 3581 1.323 0.9927

(-0.383) - NaN 0.27392 0.0886 3581 3.092 0.1210

(-0.383) - 0.309 -0.26015 0.1302 3581 -1.998 0.8000

(-0.383) - 0.383 -0.65256 0.1142 3581 -5.715 <.0001

(-0.383) - 0.500 -0.20229 0.1224 3581 -1.652 0.9467

(-0.383) - 0.707 -0.05503 0.1128 3581 -0.488 1.0000

(-0.383) - 0.809 -0.80536 0.1330 3581 -6.056 <.0001

(-0.383) - 0.924 -0.88057 0.1152 3581 -7.641 <.0001

(-0.383) - 1.000 -0.52444 0.1203 3581 -4.358 0.0013

(-0.500) - (-0.707) 0.25924 0.1056 3581 2.454 0.4741

(-0.500) - (-0.809) 0.16441 0.1221 3581 1.346 0.9914

(-0.500) - (-0.924) 0.39514 0.1188 3581 3.326 0.0616

(-0.500) - (-1.000) 0.32915 0.1087 3581 3.027 0.1434

(-0.500) - NaN 0.43866 0.0779 3581 5.632 <.0001

(-0.500) - 0.309 -0.09541 0.1217 3581 -0.784 1.0000

(-0.500) - 0.383 -0.48783 0.1204 3581 -4.053 0.0046

(-0.500) - 0.500 -0.03755 0.1003 3581 -0.375 1.0000

(-0.500) - 0.707 0.10970 0.1046 3581 1.048 0.9994

(-0.500) - 0.809 -0.64063 0.1247 3581 -5.136 <.0001

(-0.500) - 0.924 -0.71584 0.1211 3581 -5.912 <.0001

(-0.500) - 1.000 -0.35971 0.1039 3581 -3.461 0.0403

(-0.707) - (-0.809) -0.09483 0.1195 3581 -0.793 1.0000

(-0.707) - (-0.924) 0.13590 0.1146 3581 1.186 0.9976

(-0.707) - (-1.000) 0.06990 0.1126 3581 0.621 1.0000

(-0.707) - NaN 0.17941 0.0713 3581 2.515 0.4297

(-0.707) - 0.309 -0.35466 0.1191 3581 -2.977 0.1630

(-0.707) - 0.383 -0.74708 0.1162 3581 -6.427 <.0001

(-0.707) - 0.500 -0.29680 0.1106 3581 -2.684 0.3147

(-0.707) - 0.707 -0.14954 0.0828 3581 -1.806 0.8962

(-0.707) - 0.809 -0.89987 0.1222 3581 -7.367 <.0001

(-0.707) - 0.924 -0.97508 0.1170 3581 -8.336 <.0001

(-0.707) - 1.000 -0.61895 0.1082 3581 -5.718 <.0001

(-0.809) - (-0.924) 0.23073 0.1313 3581 1.757 0.9148

(-0.809) - (-1.000) 0.16473 0.1238 3581 1.330 0.9923

(-0.809) - NaN 0.27424 0.0959 3581 2.859 0.2164

(-0.809) - 0.309 -0.25983 0.1226 3581 -2.119 0.7225

(-0.809) - 0.383 -0.65224 0.1328 3581 -4.913 0.0001

(-0.809) - 0.500 -0.20197 0.1265 3581 -1.597 0.9596

(-0.809) - 0.707 -0.05471 0.1187 3581 -0.461 1.0000

(-0.809) - 0.809 -0.80504 0.1252 3581 -6.432 <.0001

(-0.809) - 0.924 -0.88025 0.1334 3581 -6.598 <.0001

(-0.809) - 1.000 -0.52412 0.1197 3581 -4.378 0.0012

(-0.924) - (-1.000) -0.06600 0.1251 3581 -0.528 1.0000

(-0.924) - NaN 0.04352 0.0897 3581 0.485 1.0000

(-0.924) - 0.309 -0.49055 0.1310 3581 -3.746 0.0151

(-0.924) - 0.383 -0.88297 0.1147 3581 -7.695 <.0001

(-0.924) - 0.500 -0.43270 0.1232 3581 -3.512 0.0341

(-0.924) - 0.707 -0.28544 0.1137 3581 -2.511 0.4328

(-0.924) - 0.809 -1.03577 0.1337 3581 -7.747 <.0001

(-0.924) - 0.924 -1.11098 0.1147 3581 -9.688 <.0001

(-0.924) - 1.000 -0.75485 0.1211 3581 -6.232 <.0001

(-1.000) - NaN 0.10951 0.0872 3581 1.256 0.9957

(-1.000) - 0.309 -0.42456 0.1234 3581 -3.442 0.0429

(-1.000) - 0.383 -0.81698 0.1266 3581 -6.454 <.0001

(-1.000) - 0.500 -0.36670 0.1131 3581 -3.242 0.0792

(-1.000) - 0.707 -0.21944 0.1117 3581 -1.964 0.8195

(-1.000) - 0.809 -0.96977 0.1262 3581 -7.682 <.0001

(-1.000) - 0.924 -1.04499 0.1273 3581 -8.211 <.0001

(-1.000) - 1.000 -0.68885 0.1118 3581 -6.163 <.0001

NaN - 0.309 -0.53407 0.0954 3581 -5.597 <.0001

NaN - 0.383 -0.92649 0.0918 3581 -10.095 <.0001

NaN - 0.500 -0.47621 0.0845 3581 -5.638 <.0001

NaN - 0.707 -0.32895 0.0699 3581 -4.708 0.0003

NaN - 0.809 -1.07928 0.0992 3581 -10.884 <.0001

NaN - 0.924 -1.15450 0.0927 3581 -12.453 <.0001

NaN - 1.000 -0.79836 0.0814 3581 -9.806 <.0001

0.309 - 0.383 -0.39242 0.1324 3581 -2.964 0.1683

0.309 - 0.500 0.05786 0.1260 3581 0.459 1.0000

0.309 - 0.707 0.20512 0.1183 3581 1.734 0.9226

0.309 - 0.809 -0.54521 0.1252 3581 -4.354 0.0013

0.309 - 0.924 -0.62043 0.1330 3581 -4.663 0.0003

0.309 - 1.000 -0.26429 0.1187 3581 -2.227 0.6454

0.383 - 0.500 0.45028 0.1247 3581 3.610 0.0244

0.383 - 0.707 0.59754 0.1153 3581 5.180 <.0001

0.383 - 0.809 -0.15279 0.1351 3581 -1.131 0.9986

0.383 - 0.924 -0.22801 0.1176 3581 -1.938 0.8338

0.383 - 1.000 0.12812 0.1227 3581 1.044 0.9994

0.500 - 0.707 0.14726 0.1096 3581 1.343 0.9916

0.500 - 0.809 -0.60307 0.1290 3581 -4.676 0.0003

0.500 - 0.924 -0.67829 0.1254 3581 -5.408 <.0001

0.500 - 1.000 -0.32215 0.1097 3581 -2.937 0.1797

0.707 - 0.809 -0.75033 0.1213 3581 -6.186 <.0001

0.707 - 0.924 -0.82554 0.1161 3581 -7.111 <.0001

0.707 - 1.000 -0.46941 0.1073 3581 -4.375 0.0012

0.809 - 0.924 -0.07521 0.1357 3581 -0.554 1.0000

0.809 - 1.000 0.28092 0.1226 3581 2.291 0.5972

0.924 - 1.000 0.35613 0.1234 3581 2.886 0.2030

P value adjustment: tukey method for comparing a family of 15 estimates

> aov\_df1 <- aov(confidence~ predictability + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ predictability)

> pairs(emm)

contrast estimate SE df t.ratio p.value

1 - 3 -0.00077 0.0723 286 -0.011 0.9915

> aov\_df1 <- aov(confidence~ difficulty + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ difficulty)

> pairs(emm)

contrast estimate SE df t.ratio p.value

4 - 6 0.558 0.0392 284 14.235 <.0001

4 - 8 1.143 0.0392 284 29.165 <.0001

4 - 10 1.346 0.0392 284 34.320 <.0001

6 - 8 0.585 0.0392 284 14.918 <.0001

6 - 10 0.788 0.0392 284 20.075 <.0001

8 - 10 0.202 0.0392 284 5.162 <.0001

P value adjustment: tukey method for comparing a family of 4 estimates

> aov\_df1 <- aov(confidence~ perfGrp + Error(code), data = df1)

> emm <- emmeans(aov\_df1, ~ perfGrp)

> pairs(emm)

contrast estimate SE df t.ratio p.value

**1 - 2 0.0657 0.0297 3594 2.210 0.0272**