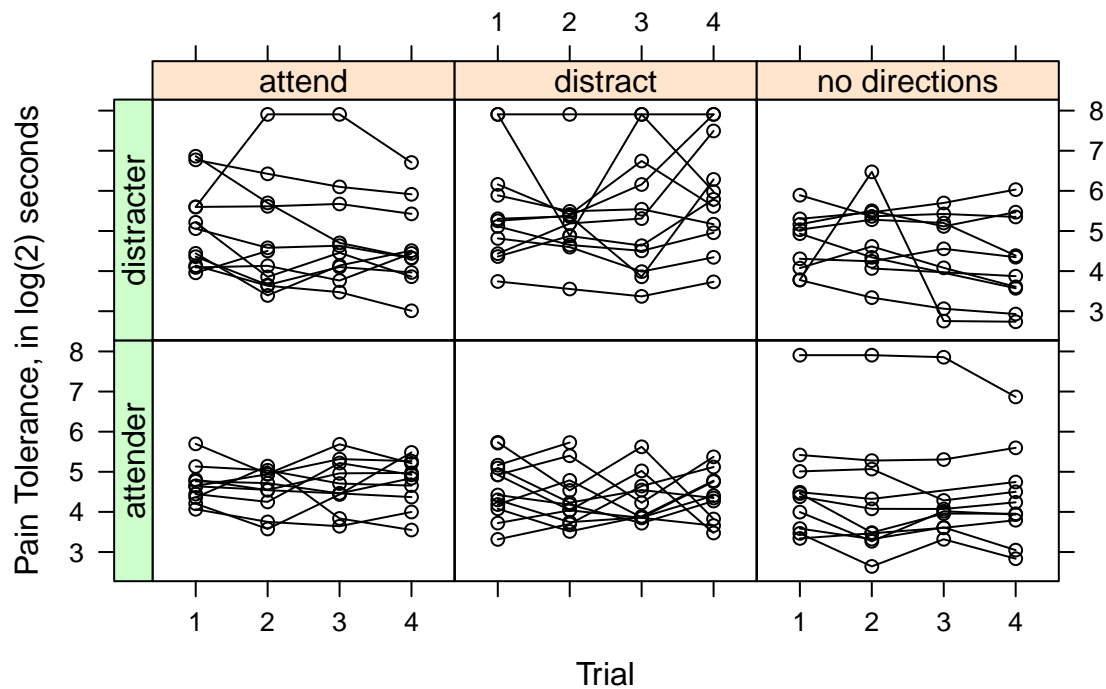


```

> pp <- read.delim("http://rem.ph.ucla.edu/rob/mld/data/tabdelimiteddata/pain.txt")
> pp <- subset(pp, !is.na(l2paintol))

> p <- xyplot(l2paintol ~ factor(trial) | treatment * cs, group = id,
+   data = pp, par.settings = allblack.theme, type = "b", xlab = "Trial",
+   ylab = "Pain Tolerance, in log(2) seconds")
> plot(useOuterStrips(p))

```



```

> ppsub <- subset(pp, id %in% c(1, 23, 39, 41), select = c("id",
+   "cs", "trial", "trt", "l2paintol"))
> print(ppsub, row.names = FALSE)

```

id	cs	trial	trt	l2paintol
1	attender	1	baseline	4.361066
1	attender	2	baseline	5.142005
1	attender	3	baseline	3.836934
1	attender	4	attend	3.549669
23	attender	1	baseline	4.925525
23	attender	2	baseline	5.399855
23	attender	3	baseline	4.226509
23	attender	4	distract	5.372952
39	distracter	1	baseline	5.599318
39	distracter	2	baseline	5.614710
39	distracter	3	baseline	5.674404
39	distracter	4	attend	5.426265
41	distracter	1	baseline	5.114783
41	distracter	2	baseline	4.651339
41	distracter	3	baseline	4.504620
41	distracter	4	distract	4.956057

Interaction

```
> m3 <- lme(l2paintol ~ cs * trt, random = ~1 | id, data = pp)
> summary(m3)

...
Random effects:
  Formula: ~1 | id
          (Intercept) Residual
StdDev:   0.8909409 0.5858537

Fixed effects: l2paintol ~ cs * trt
              Value Std.Error DF   t-value p-value
(Intercept)   4.532592 0.1693017 175 26.772276 0.0000
csdistracter   0.478031 0.2393500  62  1.997206 0.0502
trtattend      0.108192 0.2116055 175  0.511289 0.6098
trtdistract    0.038954 0.2116055 175  0.184088 0.8542
trtno directions -0.108203 0.2125829 175 -0.508990 0.6114
csdistracter:trtattend -0.459945 0.2992544 175 -1.536971 0.1261
csdistracter:trtdistract  0.537127 0.2924447 175  1.836679 0.0680
csdistracter:trtno directions -0.373634 0.3026533 175 -1.234529 0.2187
...

```

What are the X_i matrices for the four subjects on the first page?

What linear combinations of the α parameters will get us the means for

- Those with 'attending' coping style at baseline?
- Those with 'attending' coping style after the 'attend' treatment?
- Those with 'distracting' coping style at baseline?
- Those with 'distracting' coping style after the 'distract' treatment?

What comparisons between means do you think would be interesting in this case?

What linear combinations of the α parameters would we use for testing them?

Comparing the interaction model with the additive model:

```
> m2 <- lme(l2paintol ~ cs + trt, random = ~1 | id, data = pp)
> m2ML <- update(m2, method = "ML")
> m3ML <- update(m3, method = "ML")
> anova(m2ML, m3ML)
```

	Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
m2ML	1	7	592.1204	616.6292	-289.0602			
m3ML	2	10	590.6603	625.6728	-285.3301	1 vs 2	7.460178	0.0586

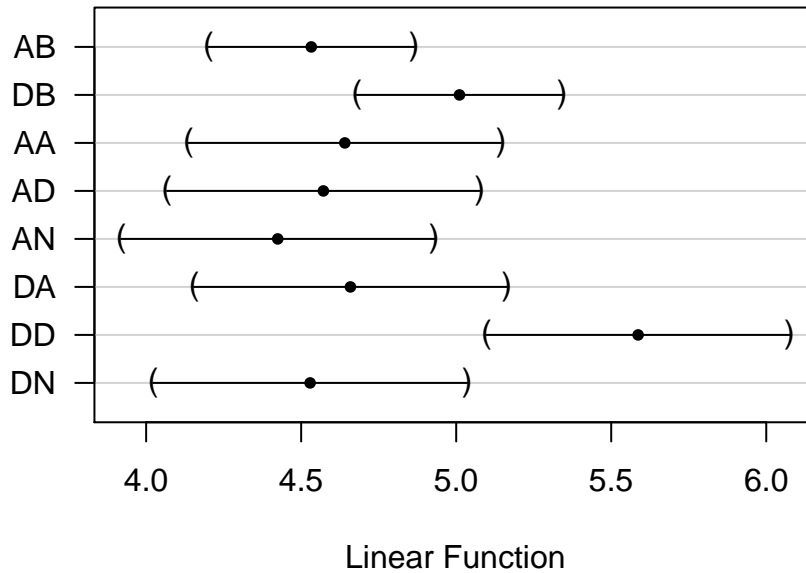
Getting the group means:

```
> K3 <- rbind(AB = c(1, 0, 0, 0, 0, 0, 0, 0), DB = c(1, 1, 0, 0,
+ 0, 0, 0, 0), AA = c(1, 0, 1, 0, 0, 0, 0, 0), AD = c(1, 0,
+ 0, 1, 0, 0, 0, 0), AN = c(1, 0, 0, 0, 1, 0, 0, 0), DA = c(1,
+ 1, 1, 0, 0, 1, 0, 0), DD = c(1, 1, 0, 1, 0, 0, 1, 0), DN = c(1,
+ 1, 0, 0, 1, 0, 0, 1))
> t3 <- glht(m3, linfct = K3)
> sum.t3 <- summary(t3, test = adjusted(type = "none"))
> ci.t3 <- confint(t3, calpha = qnorm(1 - 0.05/2))
> table.t3 <- with(sum.t3$test, data.frame(coefficients, sigma,
+ tstat))
> table.t3 <- cbind(table.t3, 2^ci.t3$confint)
> names(table.t3) <- c("est", "se", "t", "in seconds: est", "lwr",
+ "upr")
> print(table.t3, digits = 3)
```

	est	se	t	in seconds: est	lwr	upr
AB	4.53	0.169	26.8	23.1	18.4	29.1
DB	5.01	0.169	29.6	32.2	25.6	40.6
AA	4.64	0.257	18.0	24.9	17.6	35.4
AD	4.57	0.257	17.8	23.8	16.8	33.7
AN	4.42	0.258	17.2	21.5	15.1	30.5
DA	4.66	0.257	18.1	25.3	17.8	35.8
DD	5.59	0.249	22.4	48.1	34.3	67.4
DN	4.53	0.258	17.5	23.1	16.3	32.8

```
> plot(confint(t3, calpha = qnorm(1 - 0.05/2)))
```

95% confidence level



Individual Confidence Intervals for Differences:

```
> K3b <- rbind(`DA-DN` = c(0, 0, 1, 0, -1, 1, 0, -1), `DD-DN` = c(0,
+ 0, 0, 1, -1, 0, 1, -1), `DA-DD` = c(0, 0, 1, -1, 0, 1, -1,
+ 0), `AA-AN` = c(0, 0, 1, 0, -1, 0, 0, 0), `AD-AN` = c(0,
+ 0, 0, 1, -1, 0, 0, 0), `AA-AD` = c(0, 0, 1, -1, 0, 0, 0,
+ 0), `DA-AA` = c(0, 1, 0, 0, 0, 1, 0, 0), `DD-AD` = c(0, 1,
+ 0, 0, 0, 0, 1, 0), `DA-AD` = c(0, 1, 1, -1, 0, 1, 0, 0))
> t3b <- glht(m3, linfct = K3b)
> sum.t3b <- summary(t3b, test = adjusted(type = "none"))
> ci.t3b <- confint(t3b, calpha = qnorm(1 - 0.05/2))
> table.t3b <- with(sum.t3b$test, data.frame(coefficients, sigma,
+ tstat, pvalues))
> table.t3b <- cbind(table.t3b, 2^ci.t3b$confint)
> names(table.t3b) <- c("est", "se", "t", "pval", "in seconds: est",
+ "lwr", "upr")
> print(table.t3b, digits = 3)
```

	est	se	t	pval	in seconds: est	lwr	upr
DA-DN	0.1301	0.300	0.4333	0.664817	1.094	0.728	1.65
DD-DN	1.0579	0.293	3.6051	0.000312	2.082	1.397	3.10
DA-DD	-0.9278	0.291	-3.1897	0.001424	0.526	0.354	0.78
AA-AN	0.2164	0.298	0.7253	0.468294	1.162	0.775	1.74
AD-AN	0.1472	0.298	0.4932	0.621869	1.107	0.738	1.66
AA-AD	0.0692	0.298	0.2326	0.816110	1.049	0.700	1.57
DA-AA	0.0181	0.364	0.0497	0.960359	1.013	0.618	1.66
DD-AD	1.0152	0.358	2.8333	0.004607	2.021	1.242	3.29
DA-AD	0.0873	0.364	0.2400	0.810346	1.062	0.648	1.74

Simultaneous Confidence Intervals for Differences:

```
> sum.t3b <- summary(t3b)
> ci.t3b <- confint(t3b)
> table.t3b <- with(sum.t3b$test, data.frame(coefficients, sigma,
+     tstat, pvalues))
> table.t3b <- cbind(table.t3b, 2^ci.t3b$confint)
> names(table.t3b) <- c("est", "se", "t", "pval", "in seconds: est",
+     "lwr", "upr")
> print(table.t3b, digits = 3)
```

	est	se	t	pval	in seconds: est	lwr	upr
DA-DN	0.1301	0.300	0.4333	0.99698	1.094	0.622	1.926
DD-DN	1.0579	0.293	3.6051	0.00276	2.082	1.198	3.617
DA-DD	-0.9278	0.291	-3.1897	0.01151	0.526	0.304	0.909
AA-AN	0.2164	0.298	0.7253	0.96870	1.162	0.662	2.038
AD-AN	0.1472	0.298	0.4932	0.99446	1.107	0.631	1.942
AA-AD	0.0692	0.298	0.2326	0.99985	1.049	0.599	1.838
DA-AA	0.0181	0.364	0.0497	1.00000	1.013	0.510	2.009
DD-AD	1.0152	0.358	2.8333	0.03556	2.021	1.030	3.968
DA-AD	0.0873	0.364	0.2400	0.99983	1.062	0.535	2.108

```
> plot(confint(t3b))
```

95% family-wise confidence level

