Psychology 205: Research Methods in Psychology
Paper 1: A study in False Memories

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Outline

Roediger and McDermott

Meta-theoretical question

1. memory as photograph versus memory as reconstruction (memory as photo vs. photoshop)
2. "recovered" childhood memories of trauma versus ?false? memories
3. legal testimony of accuracy of memory

Roediger and McDermott- background

Prior work

1. memory distortions over time – Bartlett
2. reconstructive memory – Loftus
3. low error rates in recognition memory – Underwood
4. intrusions in free recall – Deese

Loftus and Palmer (1974)

1. The participants were 45 students of the University of Washington. They were each shown seven film-clips of traffic accidents. The clips were short excerpts from safety films made for driver education. The clips ranged from 5 to 30 seconds long.
2. Following each clip, the students were asked to write an account of the accident they had just seen. They were also asked to answer some specific questions but the critical question was to do with the speed of the vehicles involved in the collision.
3. There were five conditions in the experiment (each with nine participants) and the independent variable was manipulated by means of the wording of the questions. For example:
   - Condition 1: 'About how fast were the cars going when they smashed into each other?'
   - Condition 2: 'About how fast were the cars going when they collided into each other?'
   - Condition 3: 'About how fast were the cars going when they bumped into each other?'
   - Condition 4: 'About how fast were the cars going when they hit each other?
   - Condition 5: 'About how fast were the cars going when they contacted each other?'

Loftus and Palmer (1974)

- Condition 1: 'About how fast were the cars going when they smashed into each other?'
- Condition 2: 'About how fast were the cars going when they collided into each other?'
- Condition 3: 'About how fast were the cars going when they bumped into each other?'
- Condition 4: 'About how fast were the cars going when they hit each other?
- Condition 5: 'About how fast were the cars going when they contacted each other?'

The basic question was therefore 'About how fast were the cars going when they ***** each other?'. In each condition, a different word or phrase was used to fill in the blank. These words were; smashed, collided, bumped, hit, contacted.

From http://www.holah.co.uk/study/loftus/

Underwood, 1965

1. A master of verbal learning (before the cognitive revolution)
2. Varied word type in a running recognition task.
   - Stimulus words (Bottom, give, day, man, ... butter, crumb, ... bed, dream, ...
   - Antonyms (Top, take, night, ... ? Associates (bread, .. sleep, ...
3. Varied number of repetitions of each cued word.
4. Low but reliable number of false recognitions
5. Increased effect for words that were repeated three times

Deese, 1959

1. Another verbal learning master
2. Lists consisting of 12 words each were presented to 50 Ss for a test of immediate recall. In the recall of these lists, particular words occurred as intrusions which varied in frequency from 0% for one list to 44% for another.
3. Data gathered on word- association frequencies clearly showed that the probability of a particular word occurring in recall as an intrusion was determined by the average frequency with which that word occurs as an association to words on the list.

Roediger and McDermott

1. Alternative explanations for memory effects
   - (1) connection strength models of memory
   - (2) network models of association
2. Theoretical statement
   - not testing theory but rather testing phenomenon
   - need to get a robust measure of false memory in order to study it

Roediger and McDermott Study 1

1. Materials
   - (a) 6 lists of 12 words with high associates of 6 target lures
   - (b) recognition list
   - 12 studied words ii) 6 target lures
   - 12 weakly related iv) 12 unrelated
2. Procedure
   - (a) verbal presentation of each list
   - (b) free recall after each list
   - (c) recognition 2 minutes after all lists had been presented
3. Results
   - (a) recall shows serial position effects
   - (b) intrusion errors almost as strong as low point of serial position
   - (c) recognition errors are frequent

Roediger and McDermott Study 2

1. Materials
   - (a) 16 lists
2. procedure
3. results

Our replication and extension

1. A conceptual replication of R & M
2. Same basic paradigm, same word lists, slight differences in timing
3. But added the variable of seeing versus hearing
4. Two primary Independent Variables:
   - Mode of presentation (Oral versus Visual) ?
   - Recall vs. math
5. Based upon prior work in 205, observed lower rates of subsequent false recognition than R & M. Was this due to modality of presentation
6. Within subject study (why?)

The basic design

1. Independent Variables
   - Mode of presentation
   - Recall vs. math
2. Dependent variables
   - Recall per list (examine order effects)
   - Recognition of
     - real words (varying by position)
     - false words
     - control words
3. Design mixed within (mode and recall) with order (between)

Within subject threats to validity

1. Order effects
    - Learning
    - Fatigue
    - Materials
2. Confounding of Independent variables
    - We want to have no correlation between independent variables

Getting the data

The data are stored on a web server and may be accessed from there using the `read.file` function.
After reading the data, it useful to check the dimensions of the data and then to get basic descriptive statistics.
Before doing any analysis that requires the *psych* package, it is necessary to make it available by using the `library` command. This needs to be done once per session.
After reading in the data, we ask for the dimensions of the data as well as the names of the columns.

R code

```
library(psych)    #make psych active
file.url <- "http://personality-project.org/revelle/syllabi/205/memory.txt"
memory <- read.file(file=file.url)  #read the data from the remote site
dim(memory)   #show the dimensions of the data frame
colnames(memory)  #what are the variables?
```

```
dim(memory)
[1]  22 539
colnames(memory)
  [1] "List"       "L1P1"       "L1P2"       "L1P3"       "L1P4"       "L1P5"       "L1P6
 [11] "L1P10"      "L1P11"      "L1P12"      "L1P13"      "L1P14"      "L1P15"      "L1To
```

Find Recall by ~~list~~ – do they differ?

R code

```
recall.tots <- memory[c(16,32,48,64,80,96,112,128,144,160,176,
                        192,208,224,240,256)+1]
dim(recall.tots)  #just to make sure
describe(recall.tots)  #the descriptive statistics
```

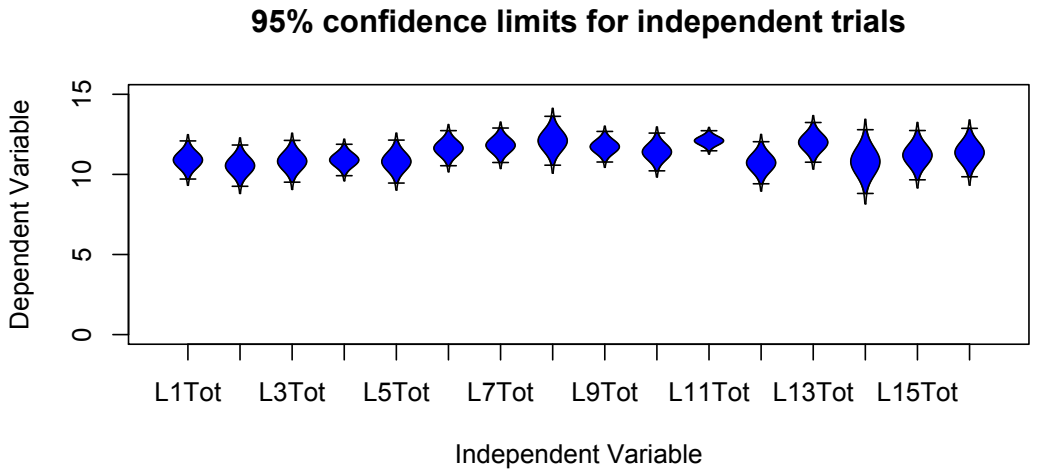
```
recall.tots <- my.data[c(16,32,48,64,80,96,112,128,144,160,176,
                         192,208,224,240,256)]
1] 22 16
 describe(recall.tots)  #the descriptive statistics
       vars  n  mean   sd median trimmed  mad min max range  skew kurtosis   se
L1Tot     1 10 10.90 1.66   10.5   10.88 1.48   8  14     6  0.14    -0.78 0.53
L2Tot     2 11 10.55 1.92   10.0   10.67 2.97   7  13     6 -0.33    -1.10 0.58
L3Tot     3 11 10.82 1.94   10.0   10.67 1.48   9  14     5  0.53    -1.37 0.58
L4Tot     4 10 10.90 1.37   11.0   11.00 1.48   8  13     5 -0.54    -0.32 0.43
L5Tot     5 10 10.80 1.87   10.5   10.62 2.22   9  14     5  0.35    -1.58 0.59
L6Tot     6 11 11.64 1.63   12.0   11.78 1.48   9  13     4 -0.60    -1.44 0.49
L7Tot     7 11 11.82 1.60   12.0   11.78 1.48   9  15     6  0.13    -0.49 0.48
L8Tot     8 10 12.10 2.13   12.0   12.12 2.22   9  15     6 -0.05    -1.35 0.67
L9Tot     9 11 11.73 1.42   12.0   11.67 1.48  10  14     4  0.06    -1.62 0.43
L10Tot   10 10 11.40 1.65   11.5   11.25 0.74   9  15     6  0.63    -0.15 0.52
L11Tot   11 10 12.10 0.88   12.0   12.12 1.48  11  13     2 -0.16    -1.81 0.28
L12Tot   12 11 10.73 1.95   10.0   10.67 1.48   8  14     6  0.49    -1.09 0.59
L13Tot   13 11 12.00 1.84   11.0   11.89 1.48  10  15     5  0.26    -1.69 0.56
L14Tot   14 10 10.80 2.78   11.0   11.12 2.97   5  14     9 -0.74    -0.69 0.88
L15Tot   15 10 11.20 2.15   11.5   11.50 0.74   6  14     8 -1.14     0.77 0.68
L16Tot   16 11 11.36 2.25   12.0   11.44 2.97   8  14     6 -0.37    -1.57 0.68
```

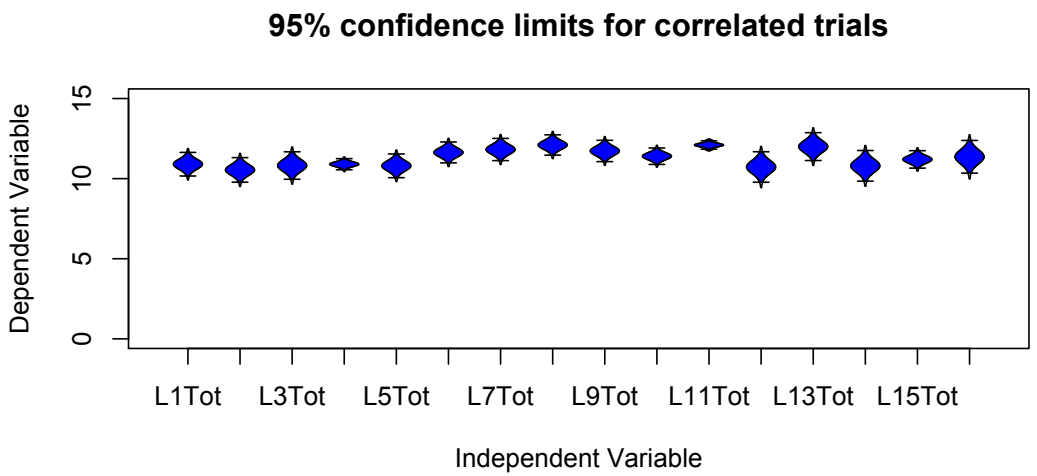
Two ways to graph the means

R code

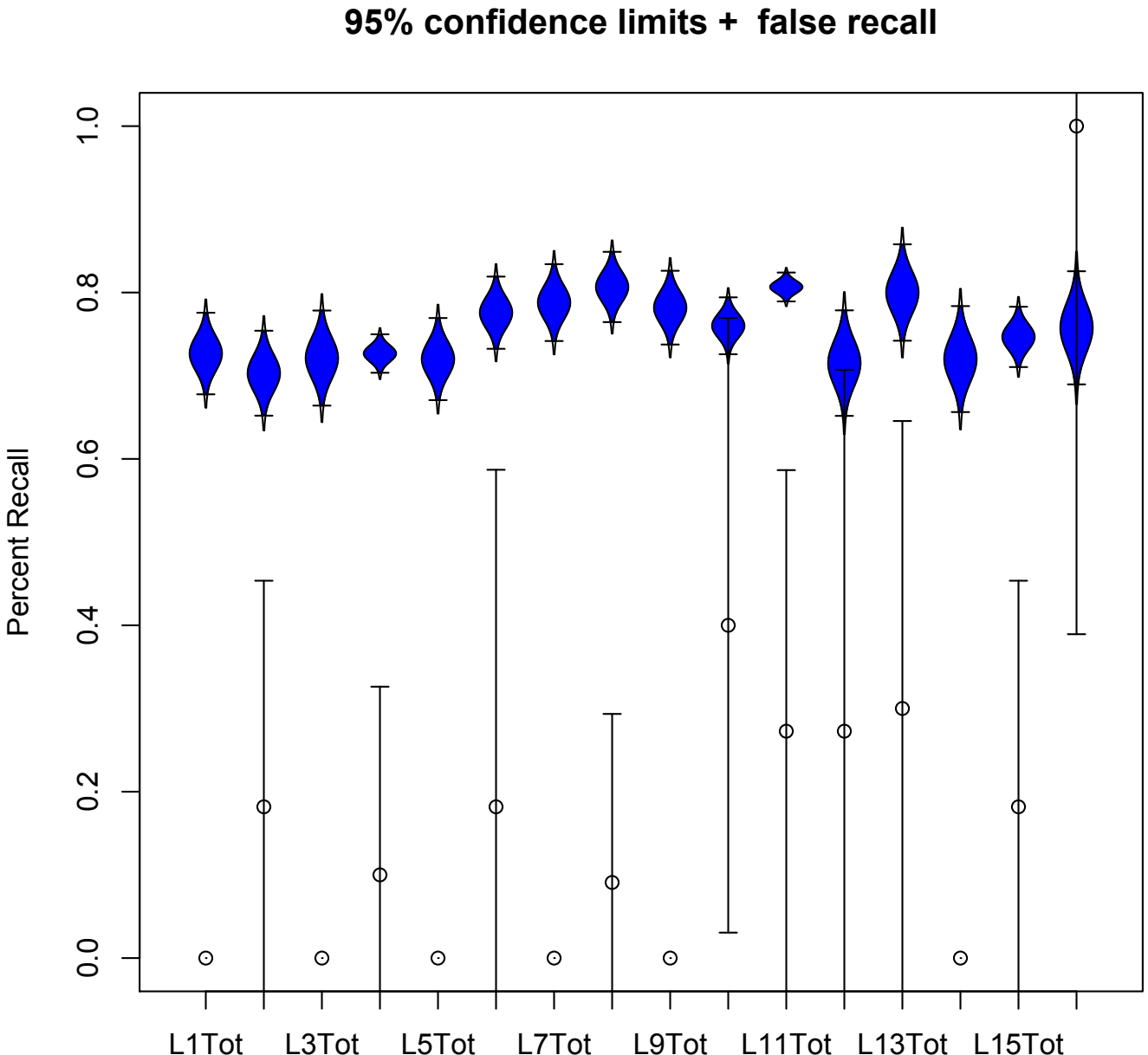
```
par(mfrow=c(2,1))
error.bars(recall.tots,ylim=c(0,15),main="95\% confidence limits fo
error.bars(recall.tots/15,within=TRUE,ylim=c(0,1),ylab="Percent Rec
par(mfrow=c(1,1))  \# put it back to a 1 up
error.bars(mem[,291:306], add=TRUE,eyes=FALSE)
error.bars(mem[,274:289],add=TRUE,eyes=FALSE)
```

Two ways t draw error bars





Combine real recall with false recall



What about serial position effects

1. Why do we care about serial position?
2. If subjects were following directions, then the first and last words should have been remembered better than the intermediate words.
3. Earlier theories of serial position suggested that the recency portion was a measure of short term memory, the lower part of the middle of the curve was longer term storage.
4. But it was then found that serial position happens for many sequential phenomena (e.g. football games).

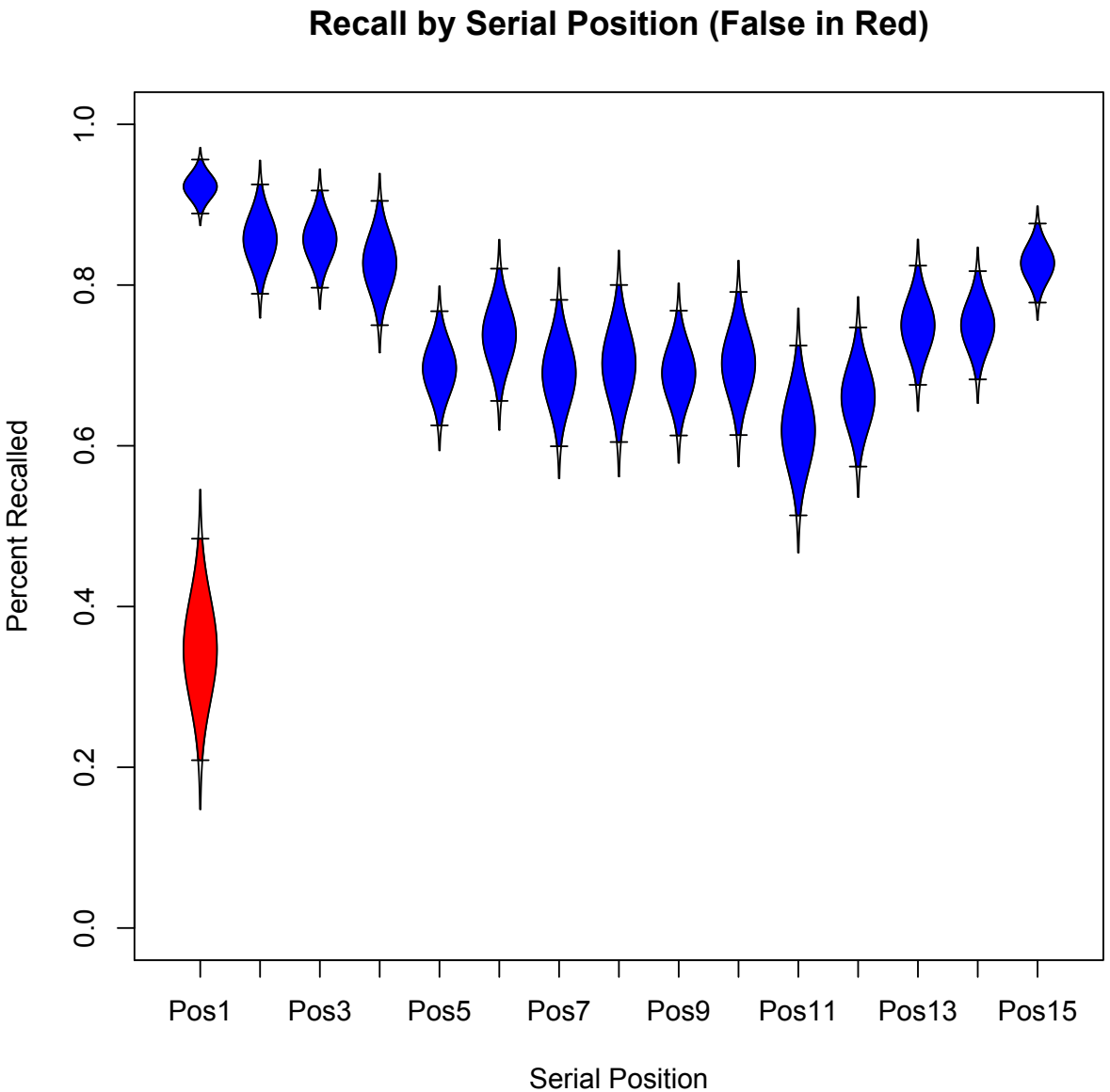
Scoring for serial positions

We need to combine across lists for position 1, then across lists for position 2, etc.

R code

```
mem <- memory[-1] #get rid of the first column
nsub <- 21
lists <- 16
words <- 16
word.position <- seq(1,256,16)
Position <- matrix(0,nrow=nsub,ncol=words)  #create a matrix to kee
for(i in 1:nsub) {
          for(k in 1:words) {Position[i,k]  <- sum(mem[i,word.posit
     }
     }
colnames(Position) <- paste0("Pos",1:16)
rownames(Position) <- paste0("Subj",1:21)
error.bars(Position[,1:15]/8,ylim=c(0,1),
        ylab="Percent Recalled",xlab="Serial Position",main="Recall
```

Serial Position effects including False Memory (Red)



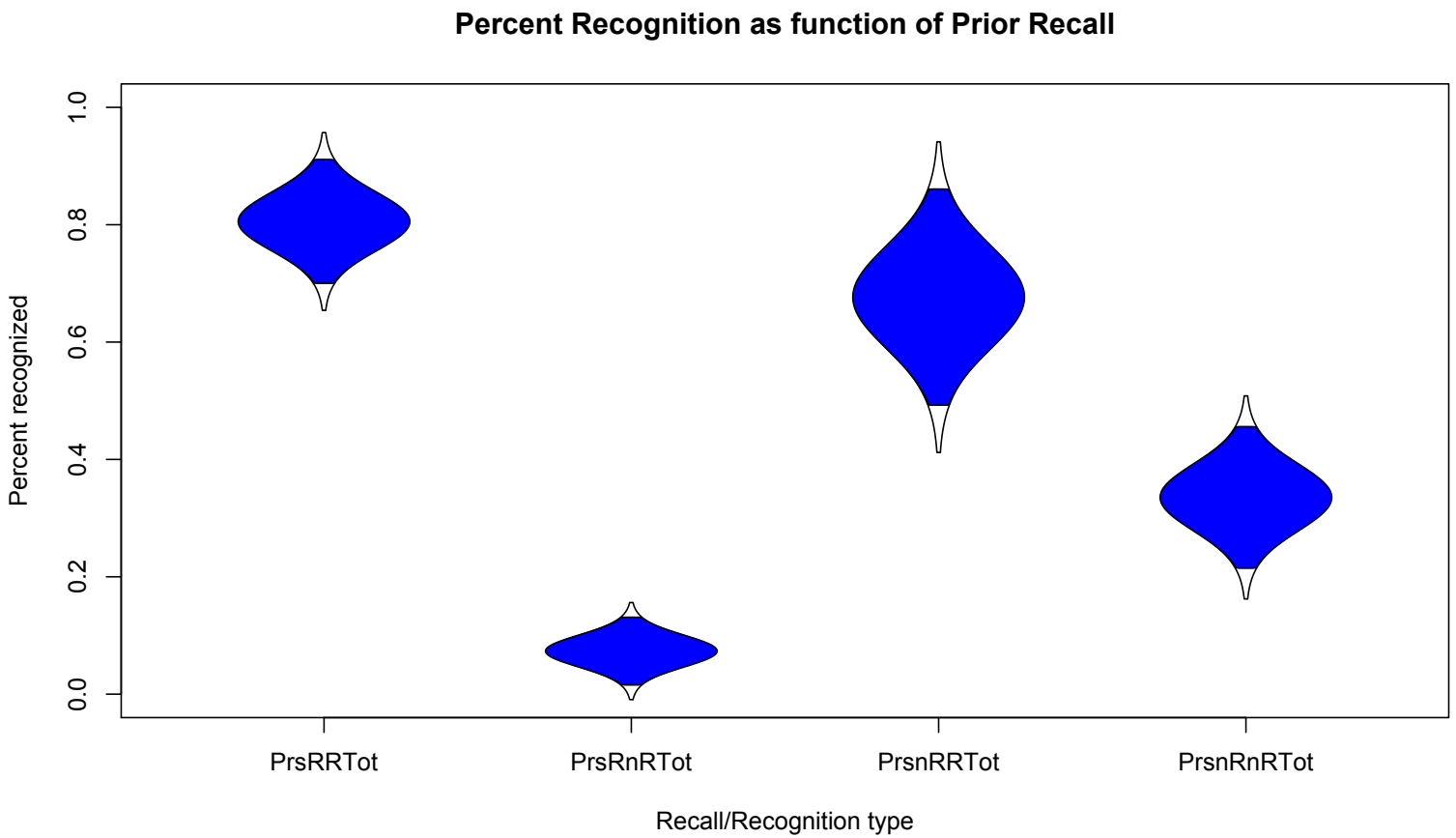
Summarize the Types of Recognition by Recall

R code

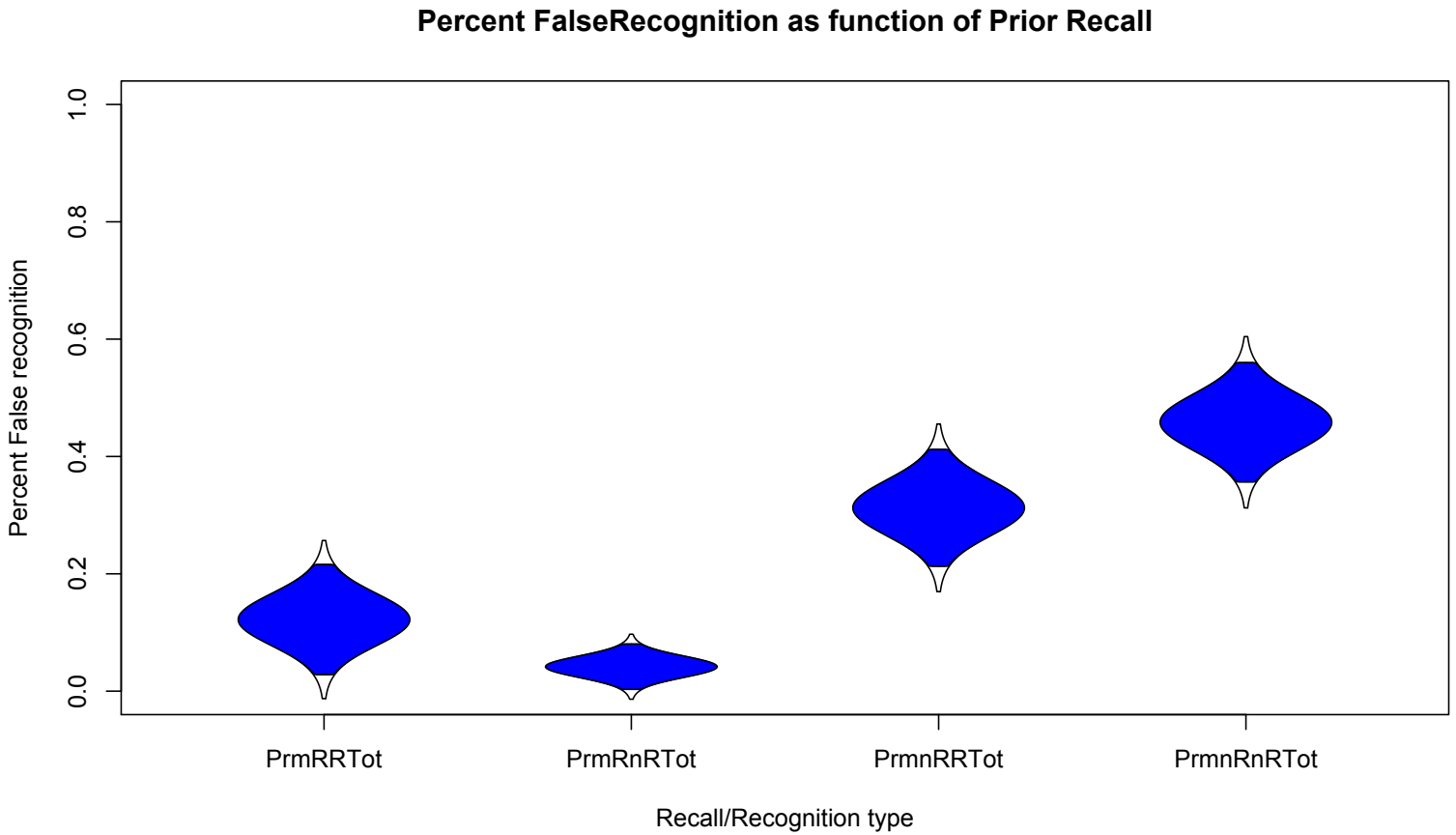
```
First, find the sums for each type
tots <- seq(323,442,17)
 describe(mem[tots])
 error.bars(mem[tots[1:4]]/24,ylab="Percent recognized",
    xlab="Recall/Recognition type",
    main="Percent Recognition as function of Prior Recall",
         ylim=c(0,1))
```

```
          vars  n  mean   sd median trimmed  mad min max range  skew kurtosis   se
PrsRRTot     1 21 19.33 5.55     18   18.71 4.45  11  36    25  1.14     1.50 1.21
PrsRnRTot    2 21  1.76 3.03      1    1.00 1.48   0  13    13  2.60     6.46 0.66
PrsnRRTot    3 21 16.24 9.71     21   16.88 2.97   0  27    27 -0.83    -0.98 2.12
PrsnRnRTot   4 21  8.05 6.34      5    7.35 4.45   2  20    18  0.74    -0.98 1.38
PrmRRTot     5 21  1.95 3.29      1    1.18 1.48   0  14    14  2.42     5.85 0.72
PrmRnRTot    6 21  0.67 1.35      0    0.35 0.00   0   4     4  1.62     1.01 0.30
PrmnRRTot    7 21  5.00 3.49      5    4.76 2.97   0  13    13  0.39    -0.47 0.76
PrmnRnRTot   8 21  7.33 3.57      8    7.41 4.45   1  13    12 -0.12    -1.14 0.78
```

Does prior recall affect subsequent recognition?



Does prior recall affect subsequent False recognition?



Still to come

1. Does Recall depend upon modality of presentation?
2. Does Correct Recognition depend upon modality of presentation and opportunity to recall?
3. Does False Recognition depend upon modality of presentation and opportunity to recall?

Find the Recognition by condition means

R code

```
mem <-mem[-22,] #remove extra line

Visual <- c(1,2,7,8,11,12,13,14)
Oral <- c(3,4,5,6,9,10,15,16)
RecallA <- c(1,4,5,8,10,11,14,15)
RecallB <- c(2,3,6,7,9,12,13,16)
Recog.cond <- c("PrsRR1" ,    "PrsRR2",     "PrsRR3"  ,
 "PrsRR4"  ,   "PrsRR5"  ,   "PrsRR6" ,    "PrsRR7" ,    "PrsRR8" ,    "PrsRR9" ,    "Prs
"PrsRR14"  ,  "PrsRR15",    "PrsRR16" ,   "PrsRnR1",    "PrsRnR2",    "PrsRnR3",    "PrsR
"PrsRnR7" ,   "PrsRnR8"  ,  "PrsRnR9" ,   "PrsRnR10" ,  "PrsRnR11" ,  "PrsRnR12" ,  "PrsR

nrecall.cond <- c("PrsnRR1",    "PrsnRR2" ,   "PrsnRR3",    "PrsnRR4",    "PrsnRR5"  ,  "
"PrsnRR11"  , "PrsnRR12",   "PrsnRR13" ,  "PrsnRR14"  , "PrsnRR15"  , "PrsnRR16"  ,  "Prs
"PrsnRnR4" ,  "PrsnRnR5"  , "PrsnRnR6" ,  "PrsnRnR7",   "PrsnRnR8" , "PrsnRnR9"  , "PrsnR
 "PrsnRnR14"  ,"PrsnRnR15",  "PrsnRnR16")
 recog <- mem[Recog.cond]
  VisArr<- rowSums(recog[RecallA[RecallA %in% Visual]],na.rm=TRUE)
  VisBrr <- rowSums(recog[RecallB[RecallB %in% Visual]],na.rm=TRUE)
 OralArr<- rowSums(recog[ RecallA[RecallA %in% Oral]],na.rm=TRUE)
  OralBrr <- rowSums(recog[RecallB[RecallB %in% Oral]],na.rm=TRUE)
recall.rec.df <-data.frame(VisAr,VisBr,OralAr,OralBr)

  nrecog <- mem[nrecall.cond]

 recog.df <- data.frame(VisAr,VisBr,OralAr,OralBr)
 VisAr <- rowSums(recog[RecallA[RecallA %in% Visual]],na.rm=TRUE) + rowSums(recog[RecallA
 VisBr <- rowSums(recog[RecallB[RecallB %in% Visual]],na.rm=TRUE) + rowSums(recog[RecallB
 OralAr<- rowSums(recog[ RecallA[RecallA %in% Oral]],na.rm=TRUE)  + rowSums(recog[RecallA
 OralBr <- rowSums(recog[RecallB[RecallB %in% Oral]],na.rm=TRUE)   + rowSums(recog[Recall
  recog.df <- data.frame(VisAr,VisBr,OralAr,OralBr)
```

The data clearly show some errors in scoring

```
> recog.df
   VisArr VisBrr OralArr OralBrr VisAnr VisBnr OralAnr OralBnr total
1      11      7      10       8      0      0       0       0    36
2       8      0       6       0      0      7       3       9    33
3       9      5       8       5      0      0       0       0    27
4       6      2       4       3      0      0       0       0    15
5      10      0      11       0      0     11       0      12    44
6      11      0       9       0      0      9       2      11    42
7      12      0      11       0      0     11       0      10    44
8       6      0       8       0      4      9       2      12    41
9       5      0       6       0      2      7       3       9    32
10      9      0      10       0      1      6       1      11    38
11      0      8       0       8      8      1       8       0    33
12      0     12       0      11     10      0      10       1    44
13      3     11       0      10      8      0      12       1    45
14      0      8       0       7      7      2       4       0    28
15      0      8       0      10      0      1       0       0    19
16      0      9       0       8     10      3      11       3    44
17      0      8       0      10      0      0       0       0    18
18      0      9       0      11     11      2      12       1    46
19      0      5       0       9      7      1      11       0    33
20      0     11       0      12     12      0      10       0    45
21      0      9       0       9     11      2       7       2    40
22      0      0       0       0      0      0       0       0     0
>
```

Fixed data

```
fixed <- edit(recog.df)
fixed<- fixed[-22,]  #get rid of the non-existent subject
 fixed
   VisArr VisBrr OralArr OralBrr VisAnr VisBnr OralAnr OralBnr total
1      11      0      10       0      0      7       0       8    36
2       8      0       6       0      0      7       3       9    33
3       9      0       8       0      0      5       0       5    27
4       6      0       4       0      0      2       0       3    15
5      10      0      11       0      0     11       0      12    44
6      11      0       9       0      0      9       2      11    42
7      12      0      11       0      0     11       0      10    44
8       6      0       8       0      4      9       2      12    41
9       5      0       6       0      2      7       3       9    32
10      9      0      10       0      1      6       1      11    38
11      0      8       0       8      8      1       8       0    33
12      0     12       0      11     10      0      10       1    44
13      0     11       0      10      8      0      12       1    45
14      0      8       0       7      7      2       4       0    28
15      0      8       0      10      0      1       0       0    19
16      0      9       0       8     10      3      11       3    44
17      0      8       0      10      0      0       0       0    18
18      0      9       0      11     11      2      12       1    46
19      0      5       0       9      7      1      11       0    33
20      0     11       0      12     12      0      10       0    45
21      0      9       0       9     11      2       7       2    40
```

Some more rearrangement ~~to look~~ for recognition by modality

R code

```
Visual <- rowSums(fixed[c(1,2,5,6)])
Oral <- rowSums(fixed[c(3,4,7,8)])
visual.oral <- data.frame(Visual,Oral)
```

```
> visual.oral
   Visual Oral
1      18   18
2      15   18
3      14   13
4       8    7
5      21   23
6      20   22
7      23   21
8      19   22
9      14   18
10     16   22
11     17   16
12     22   22
13     19   23
14     17   11
15      9   10
16     22   22
17      8   10
18     22   24
19     13   20
20     23   22
21     22   18
```

Descriptives and Inferential measures of Recognition

R code

```
describe(visual.oral)
 with(visual.oral, t.test(Visual,Oral,paired=TRUE))
```

```
   vars  n  mean   sd median trimmed  mad min max range  skew kurtosis   se
Visual    1 21 17.24 4.85     18   17.65 5.93   8  23    15 -0.58    -0.90 1.06
Oral      2 21 18.19 5.11     20   18.71 2.97   7  24    17 -0.80    -0.78 1.11

        Paired t-test

data:  Visual and Oral
t = -1.4051, df = 20, p-value = 0.1753
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -2.3662433  0.4614814
sample estimates:
mean of the differences
              -0.952381
```

In English: Words presented Orally ($\bar{X} = 18.19$, sd $= 4.85$) were slightly more recognized than those presented Visually ($\bar{X} = 17.24$, sd $= 5.11$) but this difference was not statistically significant (t (20) $= 1.41$, p=.17).

Total False Recognition

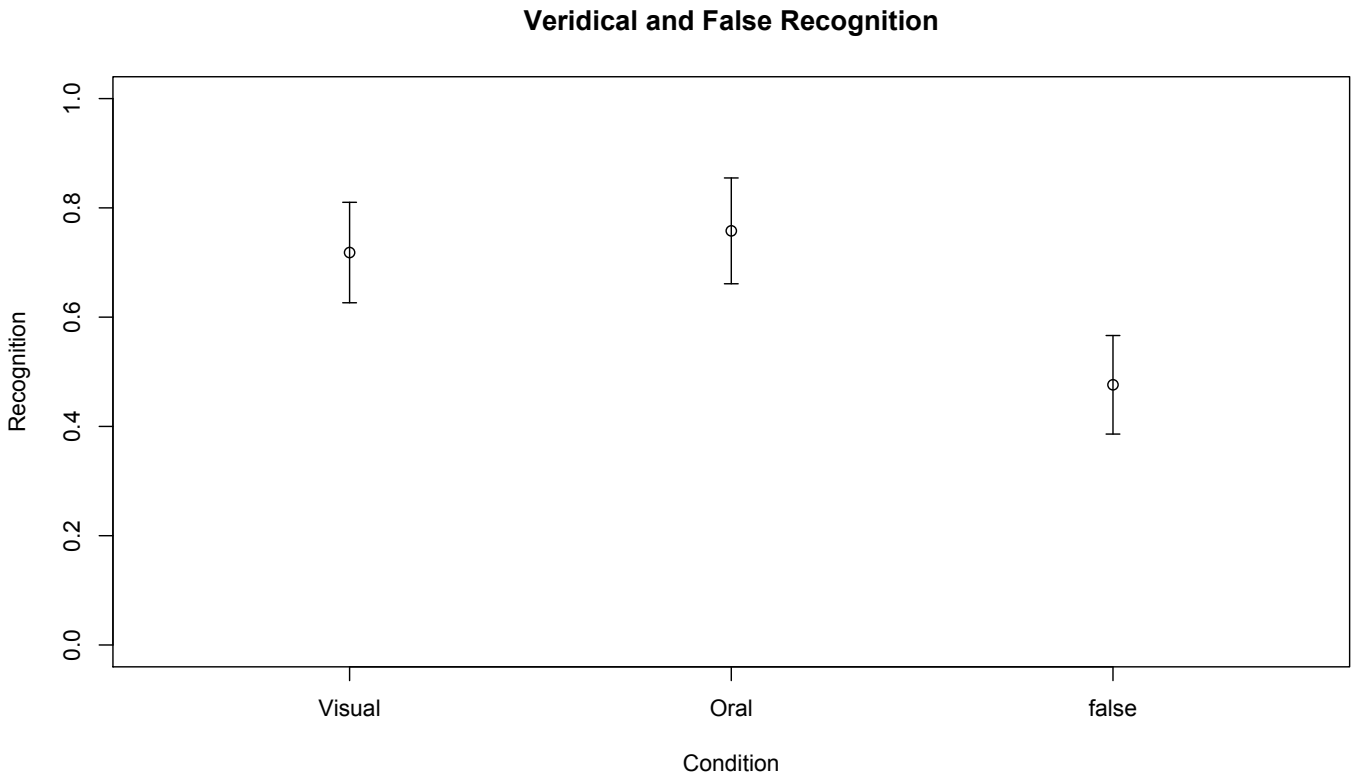
R code

```
FalseMem.names <- colnames(mem)[375:442]
total.false <- rowSums( mem[1:21,FalseMem.names[c(17,34,51)]])
recognition <- data.frame(visual.oral/24,false=total.false/16)
real.vs.false <- data.frame(real = (Visual + Oral)/48,false =total.
describe(real.vs.false)
with(real.vs.false,t.test(real,false,paired=TRUE))
```

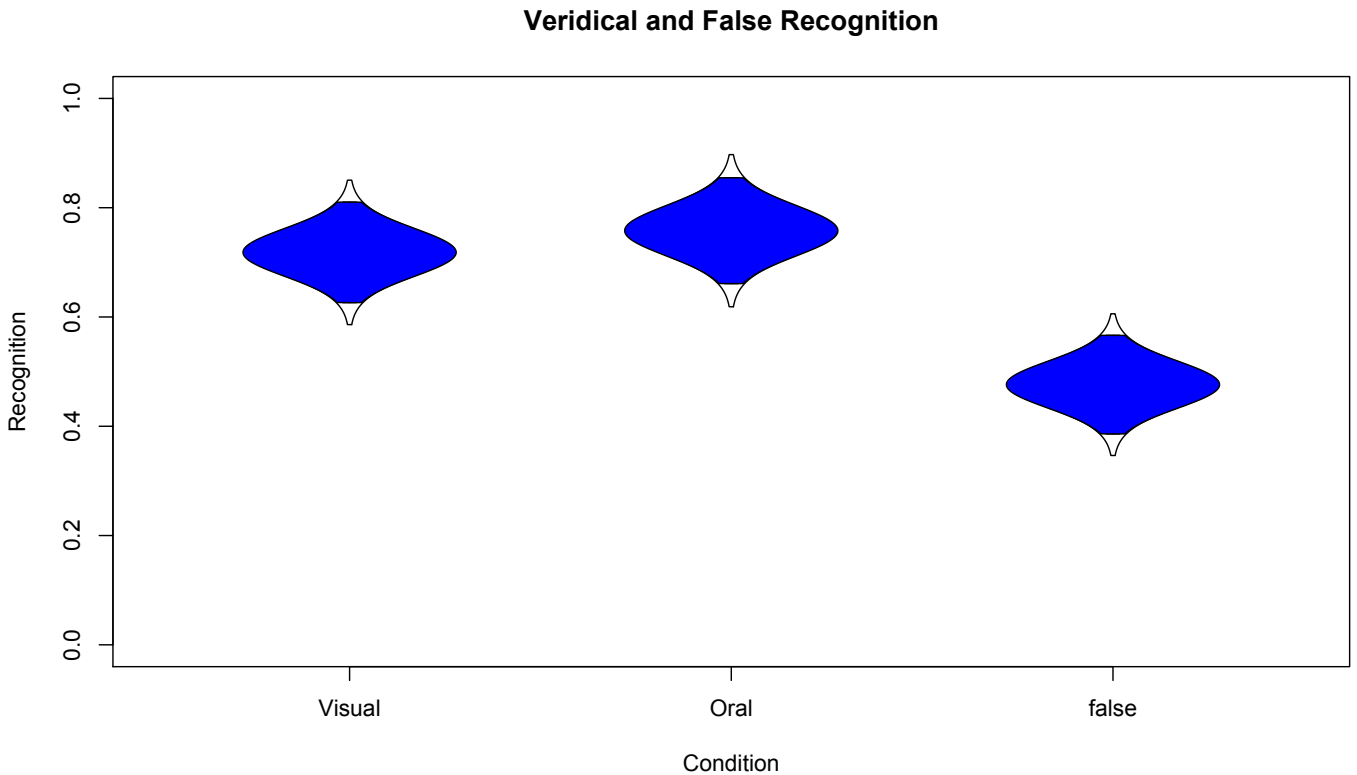
```
describe(real.vs.false)
      vars  n mean  sd median trimmed  mad  min  max range  skew kurtosis   se
real     1 21 0.74 0.2   0.79    0.76 0.19 0.31 0.96  0.65 -0.78    -0.65 0.04
false    2 21 0.48 0.2   0.50    0.46 0.19 0.19 0.94  0.75  0.56    -0.54 0.04

Paired t-test
data:  real and false
t = 4.0448, df = 20, p-value = 0.0006335
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.1268372 0.3969723
sample estimates:
mean of the differences
              0.2619048
```

In English: Real words were recognized more ($\bar{X} = .74$, sd $= .2$) than were cued but not presented words ($\bar{X} = .48$, sd $= .2$),($t(20) = 4.05$, $p = .0006$).

Two ways of showing the results (with and without cats eyes



Two ways of showing the results (Cats eyes show the confidence intervals more clearly)



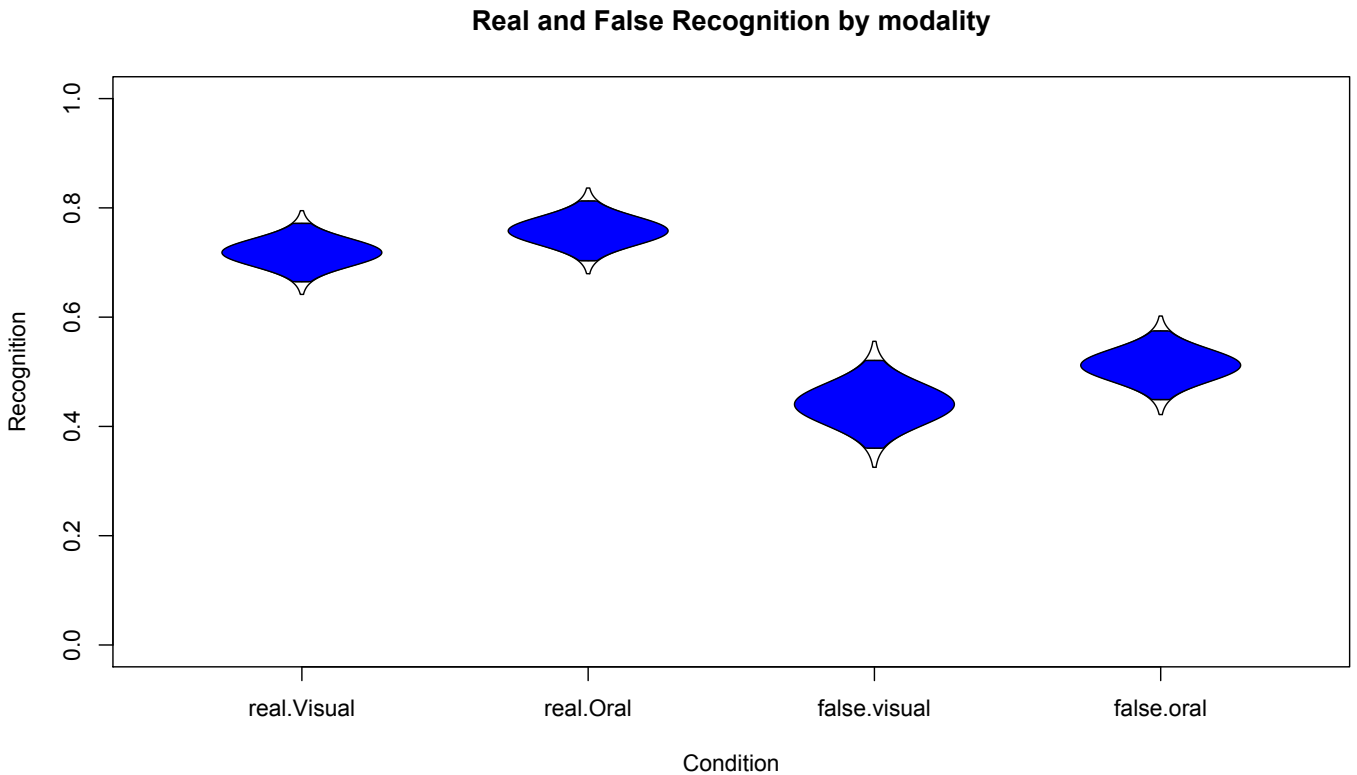
Does False recognition depend upon modality of presentation?

R code

```
falseRecog <- mem[FalseMem.names]
Visual <- c(1,2,7,8,11,12,13,14)
Oral <- c(3,4,5,6,9,10,15,16)
false.recogV <- rowSums(falseRecog[1:21,c(Visual,Visual+17,
             Visual+34)],na.rm=TRUE)
false.recogO  <- rowSums(falseRecog[1:21,c(Oral,Oral+17,
               Oral+34)],na.rm=TRUE)
false.recog.tot <- data.frame(visual=false.recogV/8,
     oral=false.recogO/8,total=(false.recogV + false.recogO)/16)
describe(false.recog.tot)
combined.df <- data.frame(real=visual.oral[1:2]/24,
                false=false.recog.tot[1:2])
error.bars(combined.df,ylab="Recognition",xlab="Condition",
   main="Real and False Recognition by modality",ylim=c(0,1),within
```

```
describe(combined.df)
             vars  n mean   sd median trimmed  mad  min  max range  skew kurtosis   se
real.Visual     1 21 0.72 0.20   0.75    0.74 0.25 0.33 0.96  0.62 -0.58    -0.90 0.04
real.Oral       2 21 0.76 0.21   0.83    0.78 0.12 0.29 1.00  0.71 -0.80    -0.78 0.05
false.visual    3 21 0.44 0.25   0.38    0.42 0.19 0.12 1.00  0.88  0.61    -0.46 0.05
false.oral      4 21 0.51 0.19   0.50    0.50 0.19 0.25 0.88  0.62  0.51    -0.99 0.04
```

Real versus False Recognition varies by Modality



Does modality affect false recognition

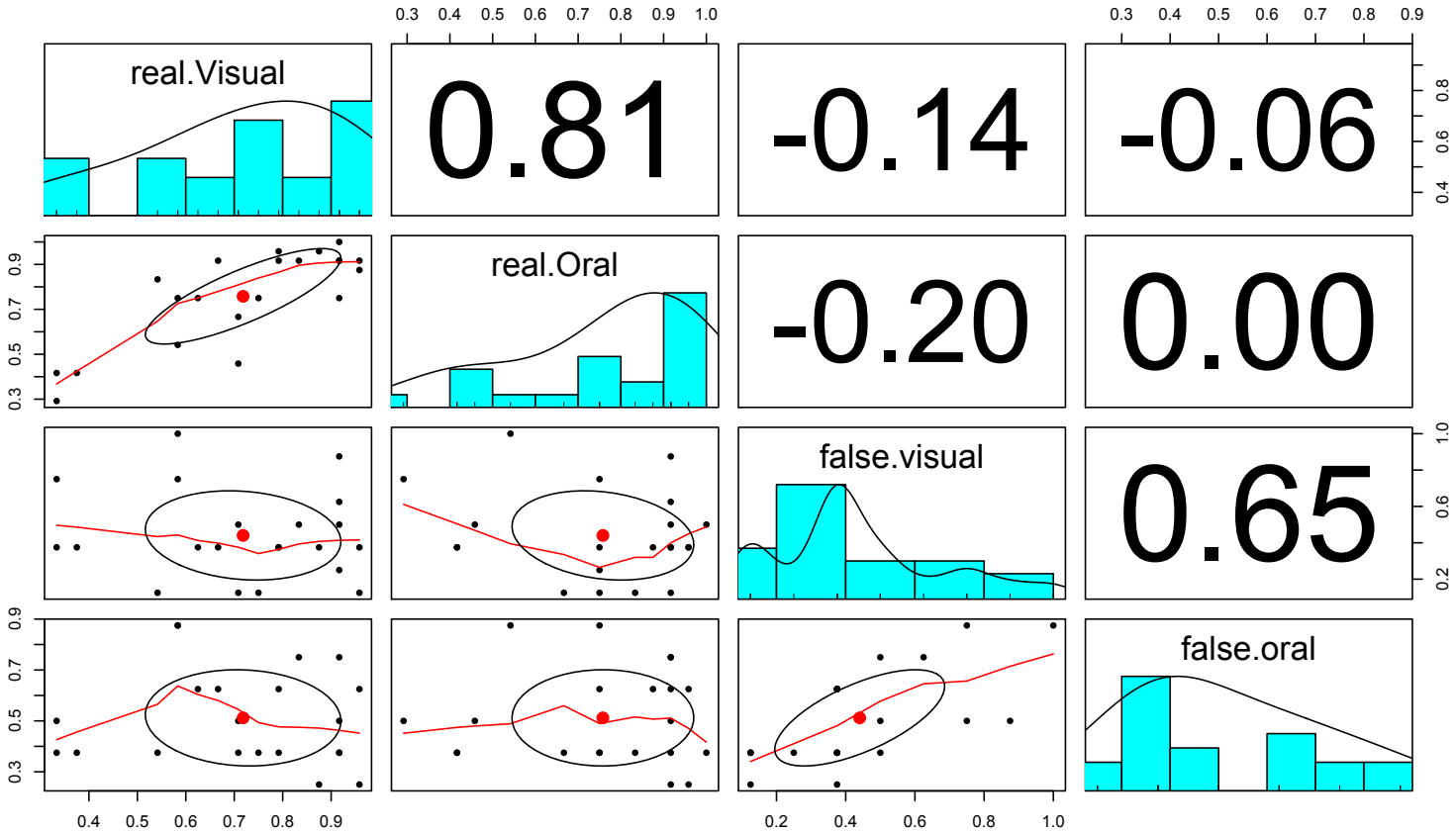
R code

```
with(combined.df,t.test(false.visual,false.oral,paired=TRUE))
```

```
Paired t-test

data:  false.visual and false.oral
t = -1.743, df = 20, p-value = 0.09669
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.15691292  0.01405577
sample estimates:
mean of the differences
            -0.07142857
```

In English: Words presented Orally ($\bar{X} = .51$, sd $= .19$) were slightly more recognized than those presented Visually ($\bar{X} = .44$, sd $= .25$) but this difference was not statistically significant (t (20) $= 1.74$, p$=.097$).

Memory as an ability, False memory as a different ability (or bias?)



Summary of Results - and what do they mean

1. Professional memorizers were able to recognize 74% of the stimulus material, but had 48% false recognitions!
2. Not due to unusual characteristics of subjects nor lack of following directions (see the serial position effects).
3. Recognition of presented words did not seem to vary as a function of modality of presentation.
4. Nor did false recognition of words vary as modality of presentation.
5. People differed in ability to recognize real words, and in the ability to recognize false words, but these did not relate to each other.
6. What are the societal implications?