Analysis of Results for: *A case study of virtual reality equivalence in a delayed match-to-sample task with a language-trained bonobo (Pan paniscus)*
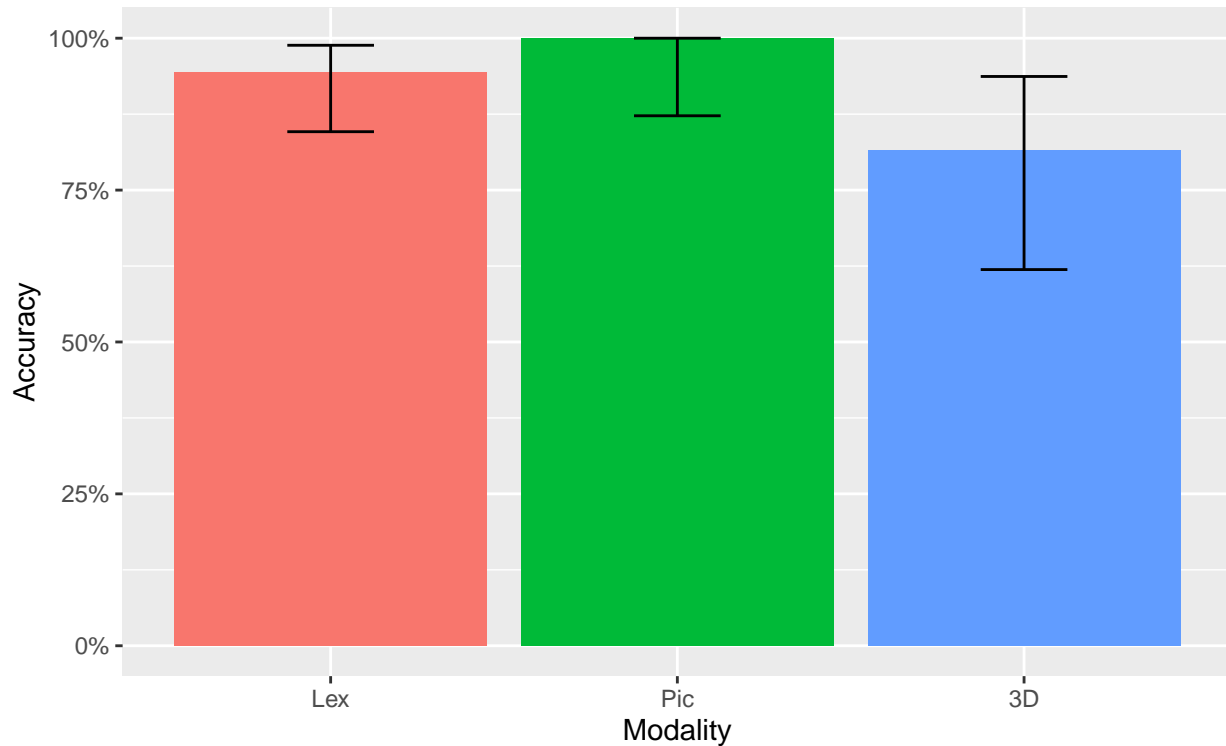
Catherine Hallsten

2021-11-15

Experiment 1

Section 2.1.1. Overall Accuracy

Modality	estimate	p.value	conf.low	conf.high
Lex	0.9444444	0.0000000	0.8461150	0.9883932
Pic	1.0000000	0.0000000	0.8722971	1.0000000
3D	0.8148148	0.0015137	0.6191701	0.9370000

Figure 8

Section 2.1.2. First Trial Accuracy

first-trial accuracy for each first pair exposure:

Correct	Total	p-Value
4	6	0.6875

first trial accuracy for each matching word:

Correct	Total	p-Value
8	12	0.3876953

2.1.3. Accuracy Compared Across Conditions

Table 1

Parameter	Coefficient	SE	CI_low	CI_high	Chi2	p
(Intercept)	14.7142857	8.202899	5.7415181	53.510310	50.1917482	0.0000000
ModalityPic	3.7378639	5.817835	0.3440647	509.539880	0.9936724	0.3188465
Modality3D	0.2780229	0.205328	0.0598337	1.137229	3.1784467	0.0746156

likelihood ratio test comparing this model to a null model:

Chi-Squared	DF	p-Value
6.055437	2	0.048426

Table 2

Parameter	Coefficient	SE	CI_low	CI_high	Chi2	p
(Intercept)	54.9999980	79.9258874	7.7300791	6972.9795165	33.7998726	0.0000000
ModalityLex	0.2675325	0.4164035	0.0019625	2.9064301	0.9936724	0.3188465
Modality3D	0.0743802	0.1139359	0.0005553	0.7136106	5.3765711	0.0204090

2.1.4. Accuracy over Time

Modality	Parameter	Coefficient	SE	CI_low	CI_high	z	p
Lex	(Intercept)	7.791778e+01	1.342292e+02	5.81222	8068.27562	2.52838	0.01146
Lex	TTN	9.540400e-01	4.185000e-02	0.85853	1.03193	-1.07268	0.28341
Pic	(Intercept)	1.268241e+11	1.084384e+16	0.00000	Inf	0.00030	0.99976
Pic	TTN	1.000000e+00	5.336994e+03	0.00000	Inf	0.00000	1.00000
3D	(Intercept)	7.268500e-01	6.932500e-01	0.10032	4.92549	-0.33450	0.73800
3D	TTN	1.174190e+00	1.033800e-01	1.01229	1.45440	1.82384	0.06818

Figure 9
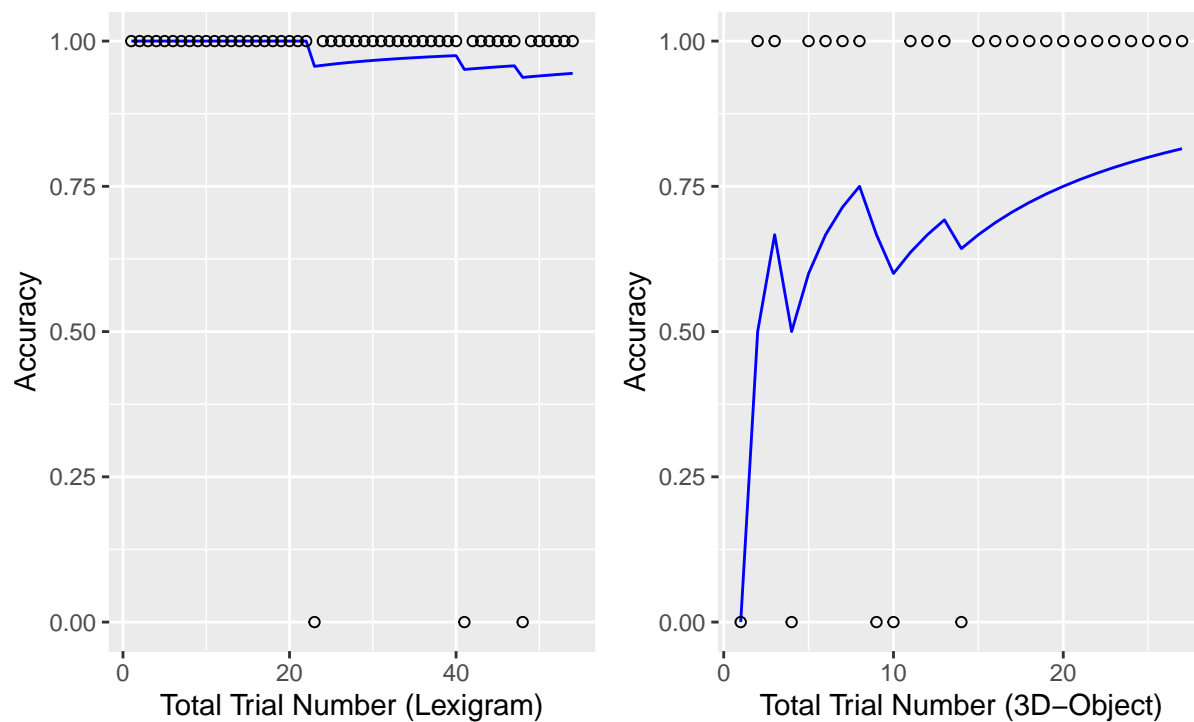
2.1.5. Latency over Time

Modality	Parameter	Coefficient	SE	CI_low	CI_high	t	p
Lex	(Intercept)	5.2380933	0.1505761	4.9354993	5.5406872	34.7870229	0.000000
Lex	TTN	0.0010905	0.0048361	-0.0086281	0.0108090	0.2254886	0.822537
Pic	(Intercept)	5.3087322	0.3378562	4.6129043	6.0045601	15.7129928	0.000000
Pic	TTN	0.0119689	0.0210886	-0.0314639	0.0554016	0.5675522	0.575401
3D	(Intercept)	5.4188322	0.3981613	4.5882821	6.2493822	13.6096390	0.000000
3D	TTN	0.0299462	0.0231001	-0.0182399	0.0781322	1.2963631	0.209610

Figure 10
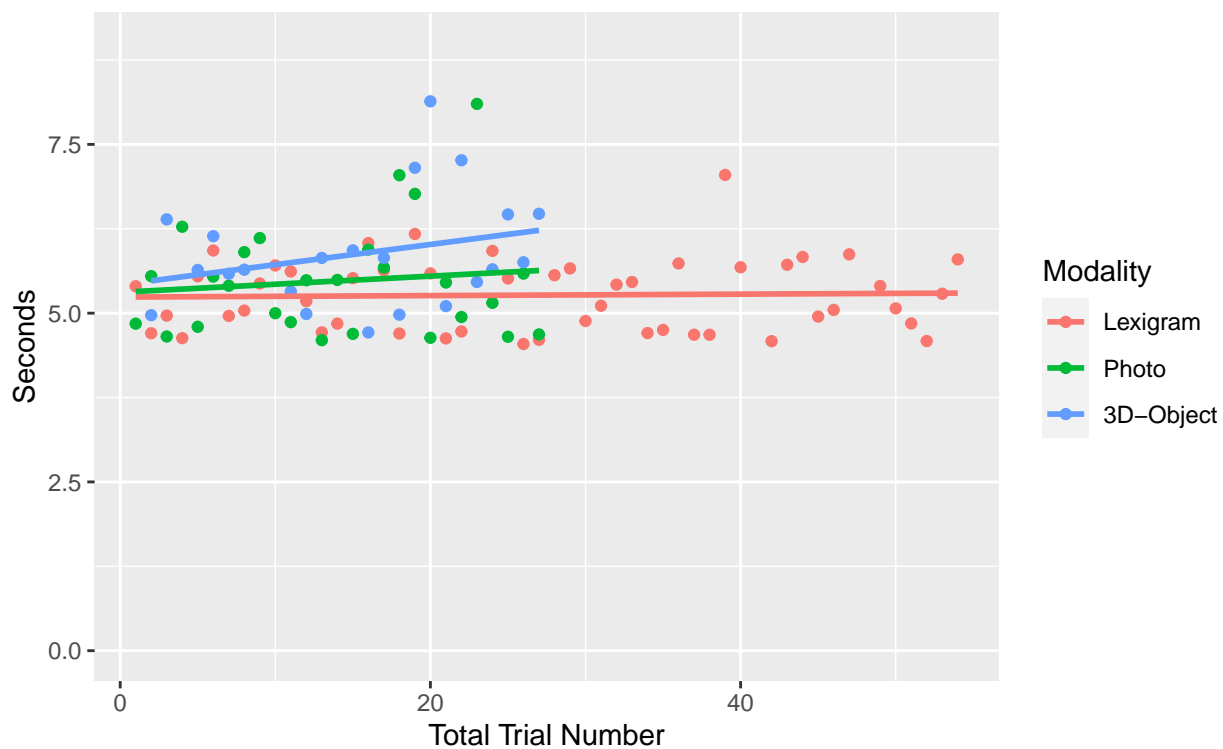
Experiment 2

2.2.1. Overall Accuracy

Modality	estimate	p.value	conf.low	conf.high
Lex	0.7916667	0.0000617	0.6500898	0.8953093
Pic	0.8333333	0.0015439	0.6261583	0.9526464
3D	0.5833333	0.5412562	0.3664306	0.7789031

Figure 11
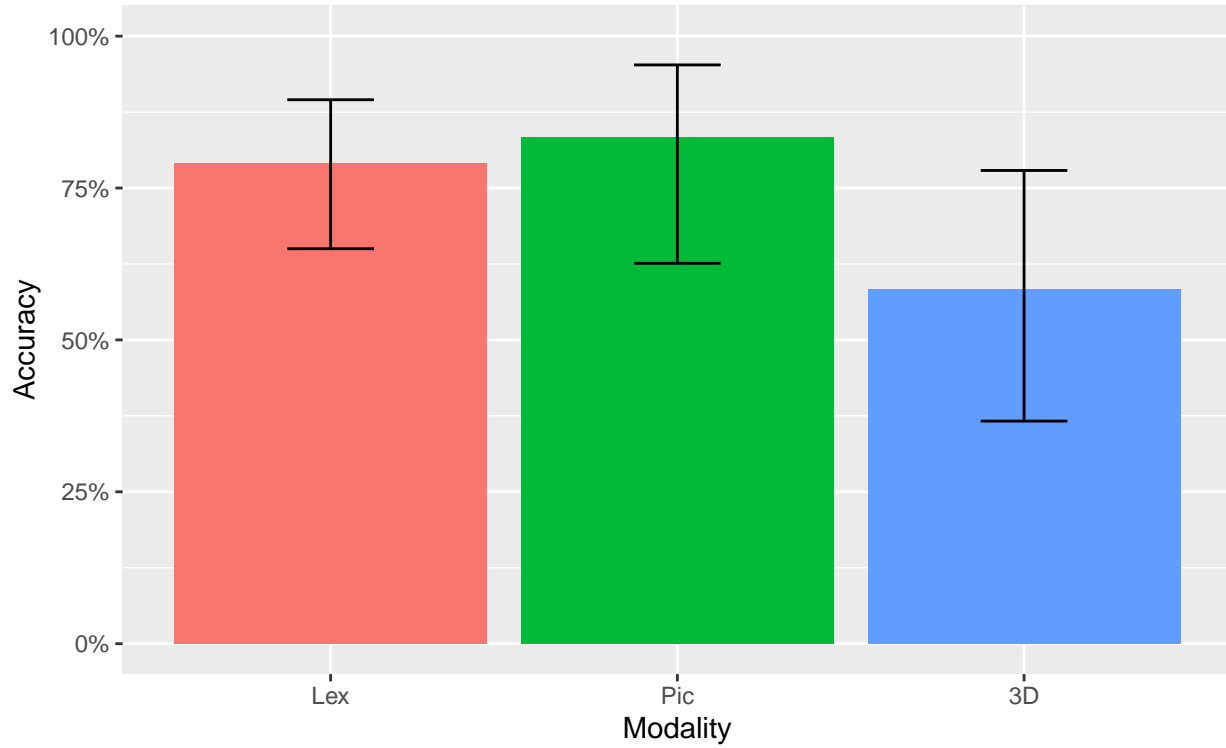
2.2.2. First Trial Accuracy

first-trial accuracy for each first pair exposure:

Correct	Total	p-Value
3	6	1

first trial accuracy for each matching word:

Correct	Total	p-Value
6	12	1

2.2.3. Accuracy Compared Across Conditions

Table 3

Parameter	Coefficient	SE	CI_low	CI_high	z	p
(Intercept)	3.8000000	1.3505549	1.9705157	8.062810	3.7562368	0.0001725
ModalityPic	1.3157895	0.8591165	0.3850466	5.279607	0.4203168	0.6742540
Modality3D	0.3684211	0.2010324	0.1241349	1.073471	-1.8299487	0.0672576

likelihood ratio test comparing this model to a null model:

Chi-Squared	DF	p-Value
4.613086	2	0.099605

Table 4

Parameter	Coefficient	SE	CI_low	CI_high	z	p
(Intercept)	5.00	2.7386128	1.8922005	17.190524	2.9384182	0.0032989
ModalityLex	0.76	0.4962257	0.1894080	2.597088	-0.4203168	0.6742540
Modality3D	0.28	0.1922498	0.0656936	1.020110	-1.8539958	0.0637398

2.2.4. Accuracy Over Time

Modality	Parameter	Coefficient	SE	CI_low	CI_high	z	p
Lex	(Intercept)	3.39817	2.41673	0.91397	15.73945	1.71999	0.08543
Lex	TTN	1.00462	0.02580	0.95469	1.05796	0.17952	0.85753
Pic	(Intercept)	14.77948	20.51521	1.51325	474.19071	1.94025	0.05235
Pic	TTN	0.92412	0.07872	0.76232	1.08332	-0.92639	0.35424
3D	(Intercept)	0.56475	0.49019	0.09245	3.07348	-0.65827	0.51036
3D	TTN	1.07721	0.06828	0.95569	1.23335	1.17326	0.24069

Figure 12
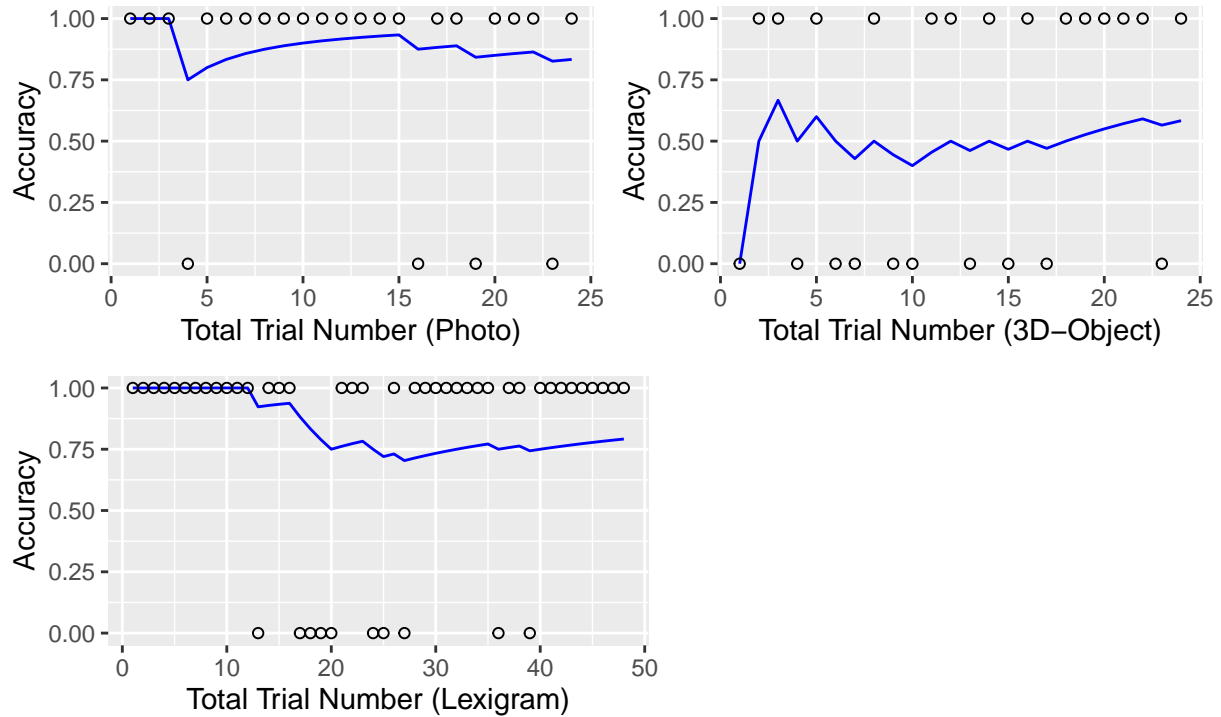
2.2.5. Latency Over Time

Modality	Parameter	Coefficient	SE	CI_low	CI_high	t	p
Lex	(Intercept)	8.4649617	0.7618768	6.9198041	10.0101194	11.1106707	0.0000000
Lex	TTN	0.0175794	0.0263642	-0.0358896	0.0710484	0.6667904	0.5091574
Pic	(Intercept)	8.8679436	0.9111791	6.9536272	10.7822599	9.7323821	0.0000000
Pic	TTN	-0.0381339	0.0666498	-0.1781600	0.1018922	-0.5721531	0.5742952
3D	(Intercept)	6.1358383	0.8785102	4.2217291	8.0499475	6.9843680	0.0000147
3D	TTN	0.1362783	0.0563316	0.0135422	0.2590143	2.4192146	0.0323638

Figure 13
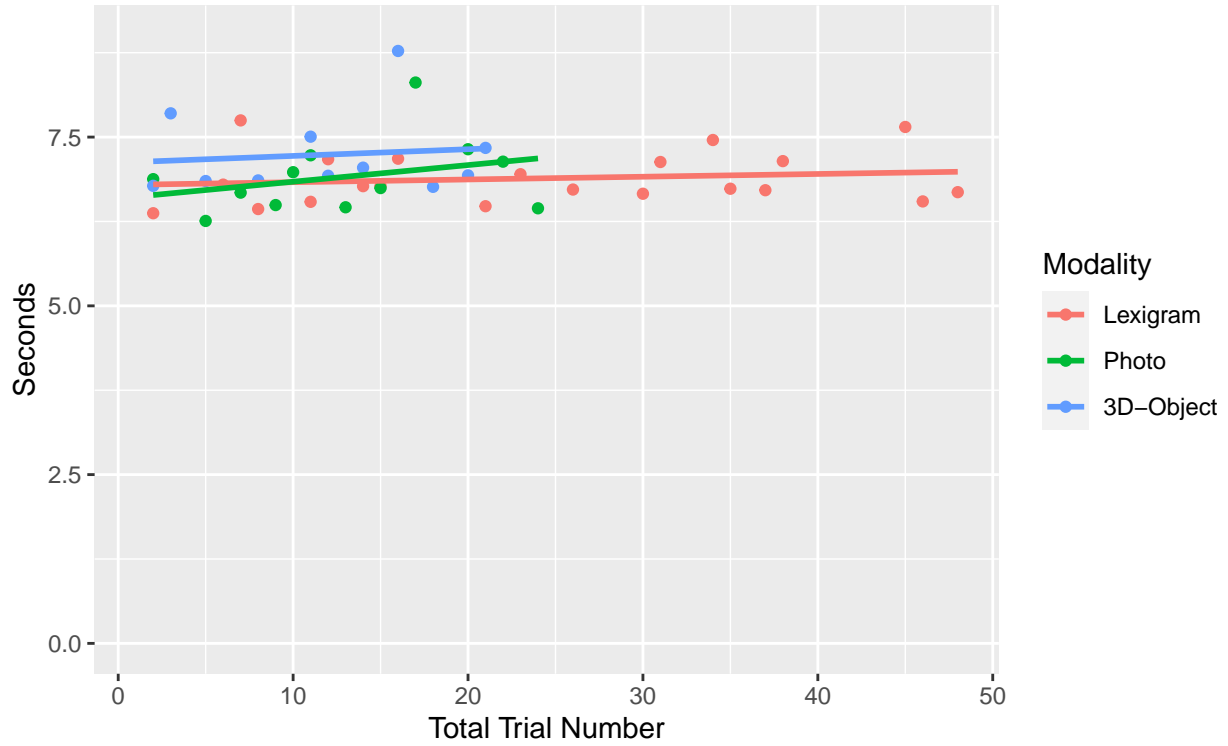
2.3. Comparison of Experiment 1 and Experiment 2 Accuracy
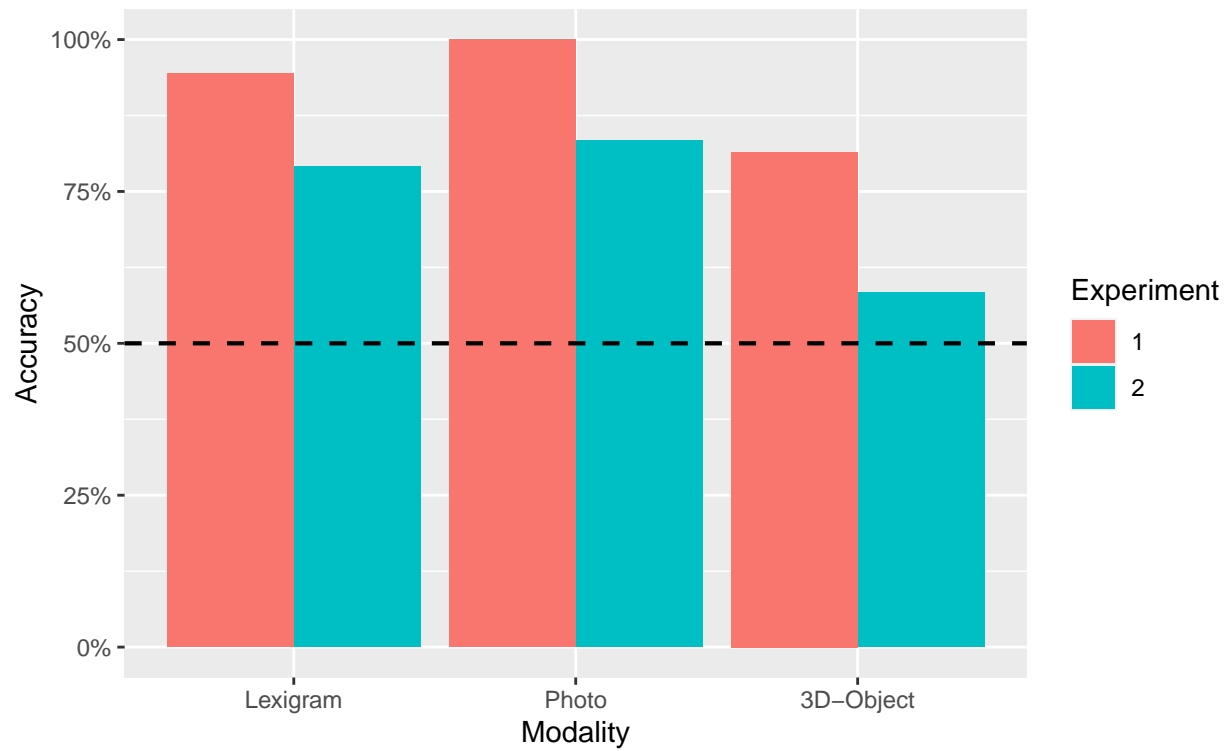
Session Info

```
## R version 4.1.0 (2021-05-18)
## Platform: x86_64-apple-darwin17.0 (64-bit)
## Running under: macOS Mojave 10.14.6
##
## Matrix products: default
## BLAS:   /Library/Frameworks/R.framework/Versions/4.1/Resources/lib/libRblas.dylib
## LAPACK: /Library/Frameworks/R.framework/Versions/4.1/Resources/lib/libRlapack.dylib
##
## locale:
## [1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
##
## attached base packages:
## [1] stats     graphics  grDevices utils     datasets  methods   base
##
## other attached packages:
##  [1] slider_0.2.2      knitr_1.36        patchwork_1.1.1   janitor_2.1.0
##  [5] logistf_1.24      broom_0.7.10      parameters_0.15.0 here_1.0.1
##  [9] readxl_1.3.1      fs_1.5.0          forcats_0.5.1     stringr_1.4.0
## [13] dplyr_1.0.7       purrr_0.3.4       readr_2.1.0       tidyr_1.1.4
## [17] tibble_3.1.6      ggplot2_3.3.5     tidyverse_1.3.1
##
## loaded via a namespace (and not attached):
##  [1] nlme_3.1-153        lubridate_1.8.0    bit64_4.0.5
##  [4] insight_0.14.5      httr_1.4.2         rprojroot_2.0.2
##  [7] tools_4.1.0         backports_1.3.0    utf8_1.2.2
## [10] R6_2.5.1            DBI_1.1.1          mgcv_1.8-38
## [13] colorspace_2.0-2    withr_2.4.2        tidyselect_1.1.1
## [16] bit_4.0.4           compiler_4.1.0     cli_3.1.0
## [19] rvest_1.0.2         mice_3.13.0        xml2_1.3.2
## [22] labeling_0.4.2      bayestestR_0.11.5  scales_1.1.1
## [25] digest_0.6.28       rmarkdown_2.11     pkgconfig_2.0.3
## [28] htmltools_0.5.2     dbplyr_2.1.1       fastmap_1.1.0
## [31] highr_0.9           rlang_0.4.12       rstudioapi_0.13
## [34] generics_0.1.1      farver_2.1.0       jsonlite_1.7.2
## [37] vroom_1.5.6         magrittr_2.0.1     Matrix_1.3-4
## [40] Rcpp_1.0.7          munsell_0.5.0      fansi_0.5.0
## [43] lifecycle_1.0.1     stringi_1.7.5      yaml_2.2.1
## [46] snakecase_0.11.0    MASS_7.3-54        grid_4.1.0
## [49] formula.tools_1.7.1 parallel_4.1.0     crayon_1.4.2
## [52] lattice_0.20-45     haven_2.4.3        splines_4.1.0
## [55] hms_1.1.1           pillar_1.6.4       reprex_2.0.1
## [58] glue_1.5.0          evaluate_0.14      modelr_0.1.8
## [61] operator.tools_1.6.3 vctrs_0.3.8       tzdb_0.2.0
## [64] cellranger_1.1.0    gtable_0.3.0       assertthat_0.2.1
## [67] datawizard_0.2.1    xfun_0.28          warp_0.2.0
## [70] ellipsis_0.3.2
```